Charles University in Prague

Faculty of Social Sciences
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MASTER THESIS

FDI and the spillover effect analysis: the case of Ethiopia

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Declaration of Authorship

The author hereby declares that he compiled this thesis independently; using only the listed resources and literature, and the thesis has not been used to obtain a different or the same degree.

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Prague, May 16, 2014

Signature

Acknowledgments

What I have done is worthy of nothing but silence and forgetfulness; yet what God has done for me is worthy of everlasting and thankful memory. God, you deserve the very first of the gross out of my acknowledgements. In addition, I would like to thank Dr. Pavel Vacek, for his keen interest to help me and his devoted supervision throughout my work. Lastly, but not least, I would like to thank those friends, and specially my hubby who have helped me in the data organization process; and my family who have all been with me in all the valleys. Hon' you take the max.

Abstract

This thesis presents the spilling over effect resulting from the foreign direct investment with a focus on the manufacturing firms. It covers extensive econometric analysis based the Central Statistics Agency's (CSA) survey on the manufacturing firms and an Input-Output matrix done by the Ethiopian Development Research Institute (EDRI). A pooled, Fixed and Random Effect estimation techniques are employed for estimating the log transferred production function augmented for the spillover proxies: Backward, Forward and Horizontal. Yet, as is stated in a lot of literatures like that of Javorcik (2004), the Cobb–Douglas production function suffers from the endogeneity problem and there is a need for a better estimation technique that can capture and solve this problem. As a result, I also used the Levinsohn-Petrin estimation technique, which used intermediate inputs as a proxy for unobservable shocks and the residuals from this estimate used as a measure of total factor productivity (TFP) of the firm. The TFP analysis from the LP estimation suggests that a one percentage point increase in the foreign presence in the downstream sectors is associated with the 1.1 percent rise in the total output of each supplying industries. Likewise, a one percentage point increase in the weighted share of output in the upstream (or supplying) sectors produced by firms with foreign capital participation is associated with the 1.2 percent decline in the total output. Yet, I have not found any significant Horizontal spillover effect.

JEL Classification	F2, F21, F23
Keywords	Foreign Direct Investment, Spillover Effect, Total Factor Productivity

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Acronyms

CSA: Central Statistics Agency

EDRI: Ethiopian Development Research Institute

FDI: Foreign Direct Investment

IPR: Investment Policy Review

IO Matrix: Input-Output matrix

ISIC: International Standard Industrial Classification

LP: Levinsohn-Petrin

MNC: Multinational Company

TFP: Total Factor Productivity

UNCTAD: United Nations Conference on Trade and Development

Master Thesis Proposal

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Proposed Topic:

FDI and the spillover effect analysis: the case of Ethiopia

Topic Characteristics:

The thesis will focus on the Foreign Direct Investment and the spillover effect analysis by taking the case of Ethiopia. FDI refers to an investment made by a company or entity based in one country, into a company or entity based in another host country; either by buying a company in the target country or by expanding operations of an existing business in that country. It has a significant degree of influence and control over the company into which the investment is made. Open economies with skilled workforces and good growth prospects tend to attract larger amounts of foreign direct investment than closed, highly regulated economies. Hence, the principal objective of the paper is to analyze productivity externalities spilling over from MNCs to the domestic firms resulting from this direct investment by the foreigners; together with its economic contribution. Given the economic theory of the small open economies and protection of infant industries in the developing countries, this analysis is reasonable and timely in this age of economic globalizations.

Poverty has remained to be a serious challenge for centuries to Ethiopia. With the motive of speeding up the stated goal of economic development, the government has adopted some way of financing, including debt and foreign aid. In order to generate foreign exchange, it has also been leasing virgin farmlands to foreign investors with incentives like tax holidays, exemption from the payment of custom duties, relief taxes on imported capital, and exemption from payment of sales and excise taxes for export commodities; at the expense of poor farmers. It has also provided an open and permissible business environment for the foreigners in insuring capital inflow to the country. However, the country is not likely to see enough capital, know-how, or technology from the foreign investors in its aim of achieving the industrialization goal; provided the domestic firms international competency level and other related factors.

Results on the spillover effect that stem from the FDI greatly vary across studies and countries. Therefore, in this paper, I will assess this effect by quantitatively analyzing the problem. As per my literature overview so far, I have not seen any concrete research on the spillover effect aspect of the FDI in Ethiopia; though there are some narrative works on the determinants and effects of the FDI. Hence, specifically, this paper will econometrically analyze the possible direct and indirect effects resulting from the FDI in Ethiopia. Firm level panel data and the national Input-Output Matrix will be obtained from the Central Statistics Agency of Ethiopia and the Ethiopian Development Research Institute respectively.

Hypotheses:

The potential working hypotheses in this paper will be:

1. The productivity externalities spilling over effects from MNCs to domestic firms from Foreign Direct Investments are hardly internalizable in the poor economies like Ethiopia.

2. The spillover effect from FDI to the domestic firms in the host country is economically significant.

3. There is a mixed effect (positive effect for the backward and negative effect for the forward linkages) of foreign direct investment.

4. The foreign firms perform better than their domestic counterparts and there is a competition effect created in the business environments.

5. The ultimate impact of FDI on output growth in the recipient economy depends on the scope for efficiency spillovers to domestic firms.

Methodology:

I will base my analysis on two main data sources coming from the Central Statistics Agency of Ethiopia (CSA) and The Ethiopian Development Research Institute (EDRI). In order to analyze the vertical and horizontal linkages in between the MNCs and Domestic firms and estimate the magnitude and direction of the effect, I will employ pooled, Fixed and random Effect estimation techniques. A production function augmented for three basic spill over proxies: Horizontal, Backward and Forward; based on previous works on the area, like that of Javorcik (2004) and Blalock(2008), will be my baseline specification. Furthermore, in analyzing the inter-industry spill-over from the FDI I will use a Panel framework with Levinsohn-Petrin approach developed by Levinsohn and Petrin (2003) for capturing the endogeneity problem residing in the standard OLS estimation of the production function.

General Outline of the Paper:

1. Data Source and Methodology

2. Literature Review/ Conceptual framework
   2.1 Theoretical background
   2.2 Empirical Evidences
3. An Overview of the Ethiopian economy and the FDI Operations
4. Data Description and Methodology
5. Estimation Results and Main Findings
6. Conclusion and Policy Implications

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Author **Supervisor**

1. Introduction

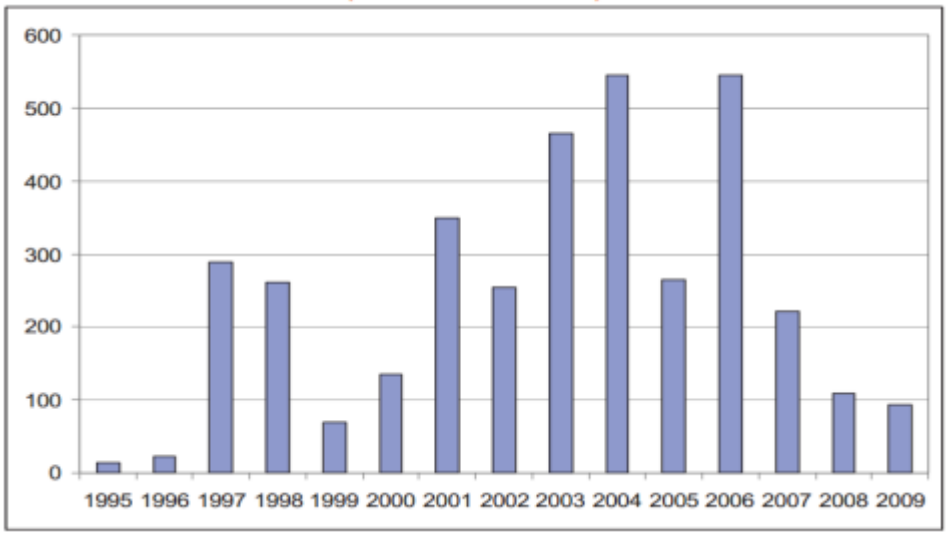
Foreign Direct Investment (FDI) refers to an investment made by a company or entity based in one country, into a company or entity based in another host country; either by buying a company in the target country or by expanding operations of an existing business in that country. The investor has a significant degree of influence and control over the company into which the investment is made. Open economies with skilled workforces and good growth prospects tend to attract larger amounts of foreign direct investment than closed, highly regulated economies. Hence, the principal objective of the paper is to analyze productivity externalities spilling over from multinational companies (MNCs) to the domestic firms resulting from this direct investment by the foreigners; together with its economic contribution. Given the economic theory of the small open economies and protection of infant industries in the developing countries, this analysis is reasonable and timely in this age of economic globalizations.

According to the 2011 [1]UNCTAD report on the implementation of the investment policy review, annual FDI inflows to Ethiopia has shown an increasing trend with almost a double increment over the years 1998 up to 2007 (from about 200 million dollars over the years 1998 up to 2002; to a more than 400 million dollars in the years between 2003 up to 2007). Yet, there is some volatility in this trend mainly because of the recent economic crisis. The report also stated that most of the foreign investments were in the manufacturing and agriculture sectors. It is believed that the country has comparative advantages three main sectors: the textile and garments, meat leather and leather products, and the agro-industry.

[1] http://unctad.org/en/Docs/diaepcb201007_en.pdf

Figure 1: Annual FDI inflows, 1995-2009

(Millions of dollars)



Source: UNCTAD report on the implementation of the investment policy review, 2011

The Turkish textile company AYKA is one of the foreign investors in the lead with initial investment of about 140 million dollars in 2007/8. It presently has about 1,200 employees; with a plan to increase its work force to 10,000. The Indian firm Karuturi Global Ltd, on the other hand, takes the lead in the agriculture and horticulture investment sectors with three hundred thousand hectares of land holding. On the other hand, a UK investor owned firm, Pittards Tannery and German footwear manufacturer Ara AG are the prominent ones in the leather sector, as compared to the other relatively small firms in the sector. In addition to these are large varieties of small-size investment projects which are more diversified type. With the growing trend of the Chinese economy, it will also be worth mentioning that the Chinese investors also take part in the FDI activity of Ethiopia with a [2]plan to develop a Chinese industrial Zone in Ethiopia. Yet, there still is a room for increasing the trend of the FDI flows to the country through stronger promotional and targeting efforts, particularly related to privatization, and opening of the financial and telecommunication sectors for investors together with due attention for the strategy to protect domestic firms in this same sectors.

[2] http://www.ohaddc.com/PDF/Ethiopia-China_Eth_Invest_Fina.pdf

With this reality of the FDI in view, this paper tries to econometrically analyze the spilling over effect resulting from the linkages between the domestic and Multinational firms. The analysis is based on a firm level data which will mainly be used for examining the industry level productivity spillovers. The paper will employ the existing methodology for analyzing a panel data. The log transformed production function augmented for the spillover proxies is the main specification estimated using a simple ordinary least square for the panel data. In addition to these is the Levinsohn-Petrin productivity estimator capturing the endogeneity problem underlying the basic production function.2004 up to 2010 are the years under coverage.

The working hypothesis for this purpose is firstly, productivity externalities spilling over effects from MNCs to domestic firms from Foreign Direct Investments are hardly internalizable in the poor economies like Ethiopia. Secondly, I tested the hypothesis that the spillover effect from FDI to the domestic firms in the host country is economically significant; which actually was proved to be in the vertical linkages. And also, I thereby tested the hypothesis which states that there is a mixed effect of foreign direct investment on the domestic firms' production capacity; with a positive effect for the backward linkages and negative effect for the forward one. There also was a trend in which foreign firms perform better than their domestic counterparts with the economies of scale and there is a competition effect created in the business environments. Therefore, ultimately, it proved that the ultimate impact of FDI on output growth in the recipient economy depends on the scope for efficiency spillovers to domestic firms.

There are two important worth mentioning limitations for this thesis. The first is that, with the financial and time constraint, the analysis is mainly based on only the industry level analysis and it does not contain the firm level analysis for the interactions between individual firms, suppliers and buyers at the very micro level. In addition, the Input-Output matrix used for this analysis purpose is only the one for the year 2006/7, which actually does not take in to account for the variety across years.

To my knowledge, there is no empirical analysis done on the spillover effect of the FDI on Ethiopia. Hence, I believe that this study will shed more light on the benefits and costs of the existing foreign direct investment; thereby stating the possible policy implications. The whole

content of the thesis is categorized in to six main parts, including the introduction. The second chapter presents the theoretical and conceptual framework about the subject. And the third chapter gives an over view to the Ethiopian economy with a detailed presentation about the trend of FDI in the country. The fourth chapter deals with the data description and methodology; with the fifth chapter presenting the data analysis and main finding of the paper. Finally, the last part concludes the thesis with further policy implications.

2. Literature review

2.1 Foreign Direct Investment- an over view

Foreign direct investment is a direct investment made by a foreign investor (a company or an individual investor) in the production or business of a given host country for a profit or other socio-economic motive. The theory of capital movements was the earliest explanation for FDI, which was viewed as a part of portfolio investments. [3]There are two types of investment: one of these is the direct investment; referring to the investment on the physical capital like that of buildings, machineries and equipment. The second type of investment is the indirect investment; mainly of a portfolio investment. The merger and acquisition of a company or an enterprise outside the investing firm's home country has also been included in the definition for the foreign direct investment following the swift growth and change in global investment trends. Within it is the direct acquisition of an overseas firm, construction of a transportation and other related facilities, or investment in a joint venture or strategic alliance with a domestic firm with assistant input of technology, and the licensing of intellectual property rights.

Seen positively, a foreign direct investment (FDI) has a paramount importance for the international business; with a key role on the economic globalization. To mention some, the creation of new markets and marketing channels, varied and new products, lower production costs with broader availability of input choices, knowledge and technological transfer, skills and means of financing are some of the benefits. The competition effect on the domestic firms is another worth mentioning; provided the recipient economy's scope of competency. And it plays a significant role in the economic development of a given country in which the investment is conducted. However, the net effect of such an investment differs across countries, mainly depending on the competency levels of the host country; as is proven in various literatures.

In the recent years, major changes in the methods, scope and sizes of the investment by the foreigners in countries other than their home country have taken place in response to the resent moves of liberalization and related changes in the regulatory framework of industries, technological advancements, with the changes in capital markets. On this regard, the radical evolution of possession rewards from the investment, and the ways in which international

[3] http://www.investopedia.com/terms/f/fdi.asp

companies transfer such rewards through the Foreign Direct Investments have been discussed in plenty of literatures. The advancement in the information technology in our age of internet and the diverse telecom services across countries have extensively ease the global communication. And this has contributed much for running foreign investments other than once own country with an ease of managerial communication across borders. This has also reduced the possible communication costs of the firms. As stated above, the policy adjustments on the industrial and trade regulation systems of nations have played a catalyzing role in fastening the pace of the foreign direct investments and the increase in their flows; of which liberalization took the lead. The changes that took in the domestic trade policies and the relaxation on the restrictions of overseas investment with a possible openness of the economy for foreign competition have a prominent contribution to this angle.

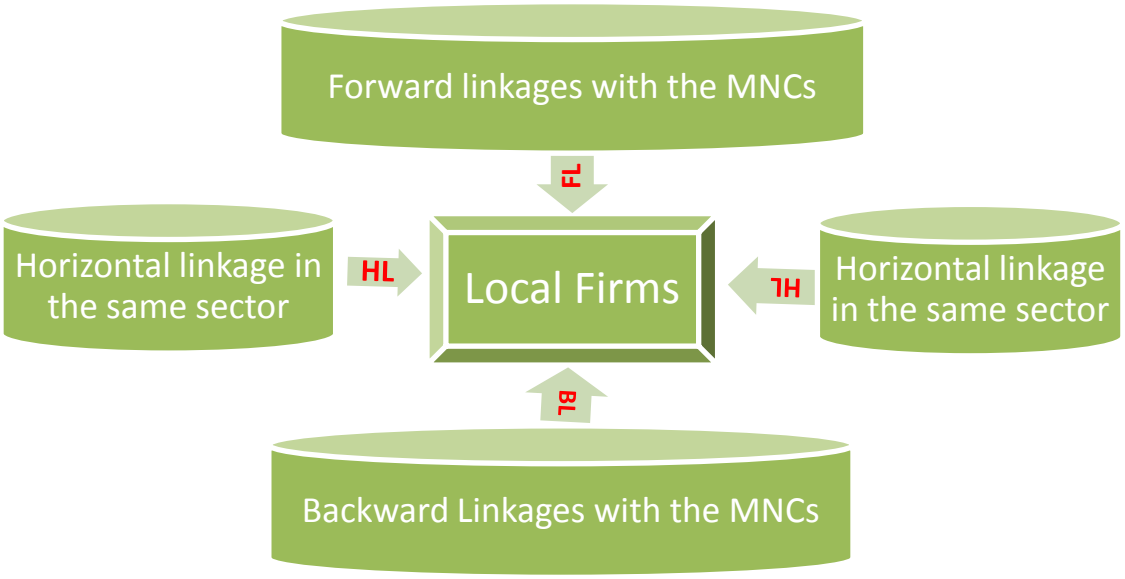
There are different views on the impact of Foreign Direct Investment. Supporters of FDI argue that the investment flows is good for both of the countries (the host and the home) that take part in such an international business deal. On the other hand, opponents point out the possible threats that international big companies can create on the domestic weak firms driving them out of the market if there is no protection for such firms. According to P. Graham and Spaulding (2005), the truth lies somewhere in the middle. They argue that for the medium and small scale enterprises, foreign direct investment creates a chance for more actively involved international business activities to the bearers. [4]More than 70% of the FDI is made in the form of fixtures, machinery, equipment and buildings and from this, big MNCs and conglomerates take the largest share. Hence, this will have another dimension on the analysis of the impact of such investment, specifically to the home country.

Some of the reasons behind making a foreign direct investment are that it allows companies to avoid foreign government pressure for local production and for eliminating trade barriers. Furthermore, it helps to shift from the local export sales to home-based national trading centers. Joint production, ventures and marketing with the domestic partners, and trading license to operate in the country other than one's origin are also some of the merits in running such a direct investment. The high impact of a significant foreign direct investment in a specific market on

[4] http://www.going-global.com/articles/understanding_foreign_direct_investment.htm

consequent investment decisions of other firms has implications for aspiring foreign markets that want to attract such an investment. And since firms tend to imitate the main market choices of well performing stronger peers, countries can profit from well directed efforts to attract FDI from large and successful companies, Tuschke et al (2010). Hence, according to them, investment decisions of these prestigious prior movers send signals about a market's attractiveness to other firms and these signals take effect beyond a firm's industry. They further stated that the strength of such signals further increases if the firm has problems to evaluate the attractiveness of a market correctly and consequently, the government of aspiring foreign markets can profit from "investing" in these signals.

Fig 2: Defining Spillovers and linkages



Where, LH = Horizontal Linkage, BL = Backward Linkage and FL = Forward Linkage, and the arrows stand for productivity spillovers.

2.2 Global Trends in the FDI flows to the Developing Countries

According to OECD (2002) report, in the Developing countries, emerging economies and countries in transition, the foreign direct investment has got a tremendous acceptance with a belief to contribute for the economic development and modernizations of these countries. As a

result, massive liberalization has taken place in these economies, together with intensive measures and policies to attract the foreign investors. The report further stated that provided the proper policies of the host and a basic level of economic development, a number of studies depict that foreign direct investment contributes for technological and knowledge transfer and helps human capital formation with a massive human capital investment. It also contributes to international marketing deal, create a more competitive business environment and to enhance industrial development and consequently adding a value to the economic growth and development of the host country, being one of the most important tool for improving the living standard of the populations in these countries. A fall in the balance of payments when profits repatriate, poor linkages of the companies with the domestic surrounding communities, the potentially negative uncompensated environmental externalities mainly from the extractive and heavy industries, social disruptions of fastening commercialization in the poor economies, and the effects on competition (Known as the competition effect) on the domestic firms were some of the drawbacks of FDI mentioned in the report.

According to World Investment Report, UNCTAD (2013) foreign direct investment flows to the developing countries showed a little overall decline in the year 2012, which might be due to the financial crises that took place in the preceding years. Yet, there have also been some bright situations to some extent. The report mentioned that the trend in Africa was somehow better; with a 5% increase in FDI inflows to about 50 billion dollars. The foreign investment in the extractive industries and the investment in the manufacturing (mainly consumer oriented) and service industries played a key role for this increment of the FDI flows. More generally, the FDI inflows to least developed countries was significantly high, with a leading flows from the developing and transition country Multinational companies (MNCs), especially from the East Asian countries like that of China, South Korea and India. Moreover, foreign direct investment flows to the [5]landlocked developing countries has also shown a moderate improvement with the rising inflows to the least developed countries in African and Latin American and a number of countries in the Central Asia. The report further stated, in the year 2012, FDI flows to the

http://www.going-global.com/articles/understanding_foreign_direct_investment.htm
http://www.oecd.org/investment/investmentfordevelopment/1959815.pdf

developing economies surpassed the flows to the developed countries by 142 billion. The net flows to these countries accounted for a more than half of the global FDI inflows in the period.

Almost half of the twenty largest foreign direct investment recipient countries are in the developing countries, reflecting a dramatic increase in the flows of FDI to these countries accounting for their improved positions in the global rankings of the top FDI recipients. The inflows to African showed a continuous rise over years. Malaysia, South Africa, China and India are the major developing economy investors in the continent in terms of stocks.

Table 2.1: FDI flows by region, 2010–2012 (Billions of dollars and percent)

Region	FDI inflows			FDI outflows		
	2010	2011	2012	2010	2011	2012
World	**1 409**	**1 652**	**1 351**	**1 505**	**1 678**	**1 391**
Developed economies	696	820	561	1 030	1 183	909
Developing economies	637	735	703	413	422	426
Africa	44	48	50	9	5	14
Asia	401	436	407	284	311	308
East and South-East Asia	313	343	326	254	271	275
South Asia	29	44	34	16	13	9
West Asia	59	49	47	13	26	24
Latin America and the Caribbean	190	249	244	119	105	103
Oceania	3	2	2	1	1	1
Transition economies	75	96	87	62	73	55
Structurally weak, vulnerable and small economies	**45**	**56**	**60**	**12**	**10**	**10**
Least developed countries	19	21	26	3.0	3.0	5.0
Landlocked developing countries	27	34	35	9.3	5.5	3.1
Small island developing States	4.7	5.6	6.2	0.3	1.8	1.8
Memorandum: percentage share in world FDI flows						
Developed economies	49.4	49.7	41.5	68.4	70.5	65.4
Developing economies	45.2	44.5	52.0	27.5	25.2	30.6
Africa	3.1	2.9	3.7	0.6	0.3	1.0
Asia	28.4	26.4	30.1	18.9	18.5	22.2
East and South-East Asia	22.2	20.8	24.1	16.9	16.2	19.8
South Asia	2.0	2.7	2.5	1.1	0.8	0.7
West Asia	4.2	3.0	3.5	0.9	1.6	1.7
Latin America and the Caribbean	13.5	15.1	18.1	7.9	6.3	7.4
Oceania	0.2	0.1	0.2	0.0	0.1	0.0
Transition economies	5.3	5.8	6.5	4.1	4.3	4.0
Structurally weak, vulnerable and small economies	**3.2**	**3.4**	**4.4**	**0.8**	**0.6**	**0.7**
Least developed countries	1.3	1.3	1.9	0.2	0.2	0.4
Landlocked developing countries	1.9	2.1	2.6	0.6	0.3	0.2
Small island developing States	0.3	0.3	0.5	0.0	0.1	0.1

Source: World Investment Report, UNCTAD, 2013

“In sub-Saharan Africa, where a large number of LDCs are present, the credit gap, the level of under financing through loans and/or overdrafts from financial institutions, for formal small and medium-sized enterprises (SMEs) is the largest in the world” , UNCTAD (2013). The small and medium sized enterprises have greater importance for the economic development. Hence, infrastructural development for underserved enterprises in developing countries is a powerful

means to support the economic progress in these countries. As a result, the investment from foreign banks as a financial catalyst has got greater support in some of the least developed countries.

2.3 Factors causing changes in FDI trends

Following the global trend of easy information flow and technological advancement, the direct investment outside of a country has grown tremendously**.** As a result of globalization and ages of technological advancement, there is a converging tendency in the preferences and tastes of across nations, resulting in an internationally uniform custom. Therefore, the potential impact of cultural diversity across nations is tending to weaken through time. Moreover, Multinational Institutions penetrated the seemingly difficult to simulate and adopt traditions and norms of the poor countries, seeking the cheap labor advantages of these countries. Consequently, these countries have come to be the second best alternative investment sites to the MNCs. Multinational firms play an important but little understood role in the transmission of macroeconomic shocks across countries. To the degree that there are non traded goods and that asset markets are not completely effective at insuring against country-specific shocks, the multinational firm may be an important mechanism for risk sharing. Like factor-price equalization in trade models, risk-sharing is often used as a benchmark in international macroeconomics to judge whether capital or other resources are distributed efficiently across countries.

Basically, there are lots of factors that can cause changes and disparities in the flow of the FDI across the globe and different regions. To mansion some:

- **Region:** Transnational institutions usually weigh potential investment sites on a categorical base of regions, rather than on a country specific identification. Geographically neighboring countries are most likely to have similar cultures, political and economic systems, and development levels. Such countries often constitute a regional economic grouping, with considerable uniformity in their trade and investment policies. For example, countries in the European Union or West African countries with a common trading zone like ECOWAS. TNCs investing in such forms stratified market groups gain a lot of advantages, mainly with a common infrastructural formation, and by

using the advantages of the intraregional trade without any barriers, and furthermore, benefit from the networking opportunities that exists in the same region. The prior flow of the multinational enterprises' investments goes to the regions which are the best composition of the conventional determinants for the foreign direct investment, Sethi et.al (2003)

- **Cost-reduction pressures:** The occurrence of massive competitive pressures in the original host region would push transnational investors to make cost effective investments into the countries which are with cheap labor forces, provided the classical profit maximization motive of firms.
- **Liberalized investment environment**: two basic factors influenced efficiency-demanding investment by the MNCs to the Developing countries. One of these resulted from massive competitive pressures in the original FDI destinations, and secondly, the widespread liberalization measures of the countries combined with the trend of economic globalization played its role. According to Sethi et.al (2003), transnational institutions' efficiency and market-seeking investments into a region basically depends on the investor-friendly liberalization policies adopted in the countries of the target region. In line to this, Tuschke et al (2010), argued that a firm's decision to engage in a foreign market is influenced by the attractiveness of the target market and by prior FDI decisions of large and successful peers.
- **Institutional prerequisites for attracting FDI:** governments should establish a favorable environment for investment through the creation of a stable political and economic environment, the rule of law, and a well organized infrastructural facility, provision of educated and technically skilled work force with an intense human capital investment, reasonably low wages, with an open economy and stable currency in order to attract sufficient Foreign Direct Investment to their economy. Yet the incentive and capitalization of the FDI in the home country depends on the development level of the destination economy. And on this regard, the optimal foreign direct investment determinants of the poor countries significantly differ from that of the one for advanced economies, and the cost efficiency resulting from a different cost of labor in these two different economies accounts for the variation in their optimal investment mixes.

2.4 The investment-development cycle: Generic model

Generic model is a descriptive model which shows the shift in the trend of the flows of foreign direct investment across countries. It depicts that transnational that transnational companies assess the potential investment destinations for their business. In the evaluation process, the conventional determinants of the foreign direct investment and the favorable business environment in the target region for their purpose of establishment play a key role. Once they identified their destination and done the cost-benefit analysis of investing in that region, the companies run towards their target area before a potential competitor takes the lead and/or share the market. As is explained well above in the regional factor for the changes and disparities in the flow of the FDI, market entry on a regional basis has a number of advantages. As we have seen above, a common infrastructure, intraregional trade without any barriers and the networking opportunities that exists in the countries with in the same region adds lots of value to invest in such a group of countries at the same time than structurally dispersed countries. The regional economic groupings like that of the EU states are some of such a kind.

There is an intense competition between the rival multinational enterprises and their rival investors, and also in between the recipient countries, especially for the emerging local players. Consequently, with the host countries motive to attract the foreign investors through all the possible incentives and the investors rush to invest in strategically important regions, there is a significant decline in the profit margins of the FDI. The multinational companies do also work on excavating new destinations for their investment and open additional marketing niches in order to keep their pace of competition with that of their rival competitors or/and even surpass, Their prior choice on this regard are those countries/regions which have conducive business environment with open economies and have well organized infrastructural facility. Even though the evaluation of the target regions is based on the traditional determinants, there also is a consideration for a different composition as compared to that of the original destinations. Such trend of acquiring new investment area and then moving forward to look for a better and less competitive destination with efficiency choices continues to circulate as long as the competition among the players prevails.

2.5 The internalization theory

The internalization theory of the Trans National Companies reflects the post war expansion in Western economies the changes in the economic environment that followed it. The Theory was developed on the back of Coase's analysis of the firm (1937). When markets present transactional imperfections there is an incentive to internalize, Gillies(2013). It is related in some way to the industrial organization hypothesis and states that FDI arises when firms are able to replace market transactions with internal transactions. Thus, such firms enjoy the advantages of lower transaction costs, the ability to minimize technology imitation and maintaining reputation by effective management and quality. Why do firms internalize? What are the limits to internalization? There are benefits of internalization and there are also costs; the balance between the two will determine the limit to internalization. The benefits of internalization stem from transactional market imperfections and relate to one or more of the following situations.

- When there are long time lags between initiation and completion of the production process and, at the same time, futures markets are nonexistent or unsatisfactory.
- When the efficient exploitation of market power over an intermediate product requires discriminatory pricing of a kind difficult or impossible to implement in an external market, though possible to implement internally.
- When imperfections would lead to bilateral concentration of market power and thus to an unstable situation under external markets.
- When there is inequality in the position of the buyer and seller regarding knowledge on the value, nature and quality of the product; the resultant buyer uncertainty may encourage forward integration.
- When there are imperfections deriving from government intervention in international markets such as the existence of ad valorem tariffs, restrictions on capital movements, discrepancies in rates of taxation.

According to Buckley and Casson (1976) in their presentation of the evolution of the Internalization Theory, towards a new Theory; they argued that the two most important areas of internalization relevant to Trans National Companies are markets for intermediate products and

markets for knowledge. Hence, imperfect markets generate incentives to internalize; and the market for knowledge is highly imperfect, so there are strong benefits in internalizing it. Their reasoning being held to the earlier decades back can't extend out to the externalization decades of the present trend. And in this regard, Gillies (2013) viewed that the internalization theory tries to explain why firms prefer the FDI rather than licensing route to growth, thus why they prefer internalization to market based relationships. However, even accepting that internalization is to be favoured because it cuts transactional costs, it is not clear why firms should prefer the FDI rather than the exporting route: the first implies internalization across borders; and the latter modality implies internalization within the nation state.

2.6 Determinants of Foreign Direct Investment

Javorcik (2004) stated some basic determinants of vertical spillovers. According to her, a firm's output dependends on capital and labor;(in line with the fundamental production theory) materials consumption, foreign share, and other proxies for FDI spillovers operating through horizontal, backward, and forward linkages. Russ (2007) on the other hand tried to view the endogeneity of the exchange rate as one of the factors determining the foreign direct investment. And he argued that when the exchange rate and the estimated sales in the host country are jointly determined by underlying macroeconomic variables, the foreign direct investment flows' functional specification on both exchange rate levels and volatility of the exchange rate will result in a biased estimation. The shocks that take place in the transnational company's home country and the host country determine the ways in which the company responds to the exchange rate volatility shock that took place. The analysis depicted a prior path in an analysis of foreign direct investment behavior with that of currency; departing from the firm-wise analytical framework.

Table 2.2: Selected indicators of FDI and international production, 1990–2012

Item	Value at current prices (Billions of dollars)				
	1990	2005–2007 pre-crisis average	2010	2011	2012
FDI inflows	207	1 491	1 409	1 652	1 351
FDI outflows	241	1 534	1 505	1 678	1 391
FDI inward stock	2 078	14 706	20 380	20 873	22 813
FDI outward stock	2 091	15 895	21 130	21 442	23 593
Income on inward FDI	75	1 076	1 377	1 500	1 507
Rate of return on inward FDI (per cent)	4	7	6.8	7.2	6.6
Income on outward FDI	122	1 148	1 387	1 548	1 461
Rate of return on outward FDI (per cent)	6	7	6.6	7.2	6.2
Cross-border M&As	99	703	344	555	308
Sales of foreign affiliates	5 102	19 579	22 574	24 198	25 980
Value added (product) of foreign affiliates	1 018	4 124	5 735	6 260	6 607
Total assets of foreign affiliates	4 599	43 836	78 631	83 043	86 574
Exports of foreign affiliates	1 498	5 003	6 320	7 436	7 479
Employment by foreign affiliates (thousands)	21 458	51 795	63 043	67 852	71 695
Memorandum:					
GDP	22 206	50 319	63 468	70 221	71 707
Gross fixed capital formation	5 109	11 208	13 940	15 770	16 278
Royalties and licence fee receipts	27	161	215	240	235
Exports of goods and services	4 382	15 008	18 956	22 303	22 432

Source: World Investment Report, UNCTAD, 2013

2.7 Empirical Evidence

A number of empirical studies have been conducted on the determinants of foreign direct investment and its spillover effect on the domestic economy, and [6]as well threaded the impacts on the host countries in relation to the ownership advantages. Theories assuming imperfect markets Hymer and Kindleberger presented the first economic analysis of FDI. FDI as an international flow of capital has been explained by capital arbitrage arguments. Some empirical works on the area, like Hymer, (1976), outlined the specific characteristics and advantages of investing firm used to explain the FDI decision. For him, due to the underlying disadvantages facing foreign firms when competing in the host country, these firms must possess a set of countervailing advantage over local firms and that the market for such advantages must be imperfect; and these advantages need to be transferrable to foreign subsidiaries. This is called the

See http://www.nber.org/papers/w7819.pdf?new_window=1, http://econweb.umd.edu/~haltiwan/olley_pakes.pdf, http://scholar.harvard.edu/files/melitz/files/prodest.pdf and http://www.nber.org/papers/w5067.pdf?new_window=1 for the details on the consideration of inputs in the production functions.

industrial organization hypothesis and has been threaded as well by some other subsequent works on FDI. Factors such as, political risk and country risk, tax policy, trade openness and governance were also used to explain FDI.

Javorcik (2004) analyzed FDI and the Productivity of Domestic firms in relation to it and explained the spillovers through backward linkages. She examined whether the productivity of local firms is correlated with the presence of transnational companies in the downstream sectors or the upstream sectors; and detection such effects in this form of analysis according to her implies a presence of vertical spillovers resulting from the foreign presence. Moreover, her paper tried to point out on determinants of vertical spillovers. She employed the semi parametric estimation method to account for endogeneity of input demand. She simply estimatimated the production function augumented for the spillover proxies using an ordinary least squares (OLS) estimation technique for a panel data framework.. Here, she took the firm's output (Y_{it}) to be considereexplained by the capital, labor, materials, foreign equity share, and proxies for FDI spillovers (Backward, Forward, and Horizontal linkage variables). She used a production function of the form:

$$\ln Y_{it}=\alpha_1+\alpha_2 \ln M_{it}+\alpha_3 \ln E_{it}+\alpha_4 \ln L_{it}+\alpha_5 \ln K_{it}+ \alpha_6 FS_{it}+\alpha_7 Backward_{it}+ \alpha_8 Forward_{it}+ \alpha_t+ \alpha_j+ \alpha_r+\varepsilon_{it}$$

Where, Y_{it} = real output of firm i at time t., is the sum of sales and a change in inventories of the firm's own products. And K_{it} is the real net tangible capital at the beginning of the year. Foreign share is the share of foreign capital in the firm's equity. It attains values from zero to one. Firms that have zero share of foreign capital in their equity are classified as "Home-owned firms." And firms with a positive foreign share are "multinationals". Proxies for spillovers: Horizontal, Backward and Forward. Horizontal captures the presence of multinational firms in given industries; measuring a share of output produced by international and foreign firms in total output of industry j at time t. $Backward_{jt}$ stands for the share of output that industry j sells to multinationals at time t. And Forward proxies the share of materials an industry buys transnational firms for its production purpose from. It is equal to the weighted share of output in supplying industries produced by firms with foreign equity shares. She analyzed the research question intensively through rigorous transformation of the basic model in order to capture the

time effect and other related factors. Furthermore, in order to employ the semi parametric estimation procedure, she formed a basic Cobb Douglas production function where observable features of the firm (the capital, labor, materials, foreign equity share, Backward, Forward, and Horizontal linkage variables) are formulated as an increasing function of the productivity of the firm. Using the survey on the manufacturing firms which was conducted by the Lithuanian Statistical Office for the period between 1996 up to 2000, her analysis result provided economically meaningful magnitude effect. In addition, her results indicates consistency with the existence of positive spillovers from FDI taking place through backward linkages, but she did not found a robust evidence on the existence a horizontal and forward linkages. Hence, she argues that the productivity of the firms for this case study showed a positive correlation to that of the extent of potential contacts with the MNCs; but not with the existence of transnational enterprises in the same sector or the existence of such enterprises in the supply chain of intermediate inputs.

Mishra (2011) conducted a study on the Indian firms, following the same approaches to that of Javorcik (2004) and Du, Harrison and Jafferson (2011). They used a firm level panel data for the Indian firms encompassing twenty-two sectors with in the manufacturing category. Their analysis was conducted using a five years data over the time period 2006 up to 2010. They followed some common ways of analysis to that of Javorcik. They employed a Panel framework with Levinsohn-Petrin approach in order to test for the inter- and intra-industrial spillovers from the foreign direct investment. Their study indicates a marginal direct impact, which actually was not statistically significant. There also were a mixed spillover effects on the productivity of domestic Indian firms resulting from the foreign direct investment inflows. They further argued that outputs of the domestic firms declines with the rise in the presence of multinationals in the upstream or/and downstream sectors and they considered this to be a sign of inefficient absorptive and adaptive capacities. According to them, the foreign firms have an inducement to assist the technological and knowledge transfers to the domestic firms enabling them to produce intermediate inputs more efficiently. And this furthermore makes the domestic firms to be a cost effective suppliers of the intermediate inputs. Yet, the lack of absorptive and adoptive capacities of the local firms makes potential knowledge and technological transfers to the country to be

suboptimal. Hence, they recommend for these capacities of domestic firms to be strengthened in order to internalize the spillover effects from the FDI.

Sethi et al. (2003) on their analysis of the Trends in foreign direct investment flows provided the reason behind the changing trends of the flow of FDI and the factors that determine a foreign direct investment (FDI) with the firm strategy and macroeconomic considerations. They tried to empirically analyze different aspects of their model at hand, using data on the United States' direct investment in the Western European and Asian countries in the period between1981 to 2000. They proposed five key propositions in this paper and focused on four of them, left the fourth proposition for further studies and provided only general statistics on the liberalization measures in developing countries.

Their propositions were; firstly, notwithstanding each multinational institution's unique direct investment location decision, collectively such flows target economically and culturally integrated regions rather than specific countries. Secondly, they proposed that the transnational investments initially flow to the region that provides the best mix of the traditional FDI determinants. Thirdly, build-up of intense competitive pressures in the original host region would cause such institutions to make efficiency-seeking investments into countries with cheap labor in order to run a cost effective business. Fourth multinational institution's' efficiency and market-seeking investments into a region will depend on the countries in that region adopting investor-friendly liberalization policies. And fifth proposition, which states that the optimal mix of the foreign direct investment determinants for low-wage countries, would be different from the mix for the developed countries which they considered them to be the original FDI destinations. The paper tried to answer the questions like "Are there a statistically significant regional pattern in the flows of US FDI to Western Europe and Asia?" And "what traditionally have been the determinants of US FDI into Western Europe?" "Is the mix of determinants of US FDI into Asia any different from them?" "What is the difference in the US FDI stocks and flows into the two regions over time?" "How have the differences in political and economic stability and wage levels between the two regions affected US FDI?" "Is cultural proximity to the USA still a significant determinant?" Their methodological analysis used empirical tests which employed numerous Ordinary Least Square (OLS) estimation techniques. And the variables under consideration for this purpose include; FDI stock, FDI flows, Dummy Europe- in order to

capture weather the country is from Europe or Asia, Wages, Wage differential, Population, GNP, Political and economic stability, Cultural differences, and Time- Time periods from 1981 to 2000.

As per their analysis, there are statistically significant changes in the regional distribution of the foreign direct investments proven from the investigation on the United States multinational enterprises direct investment. They also found a change in some of its conventional determinants of the FDI. The paper pointed out that in the period under consideration, the economic liberalization measures and the infrastructural developments across countries to some extent accounts for the shift in efficiency-seeking US's direct investment to these countries, which further have also affected the FDI trends over time. In summing up, they strongly argue that both macroeconomic and firm strategy factors must be taken in to account in explaining the changing trends of foreign direct investment (FDI) flows across countries.

Now, let us see some empirical works on the Ethiopia's Foreign Direct investment operation. Haile et al. (2006) identified the determinants and nature of Foreign Direct Investment in Ethiopia with a time-series analysis. The study gave an extensive account of the theoretical explanation of FDI and review of the policy regimes, the FDI regulatory framework and institutional set up in the country over the period 1974-2001. Using the data from IMF International Financial Statistics Year Books and the World Bank World Development Indicators CD-ROM 2003, the employed a linear regression model of FDI as a function of Growth Rate of Real Gross Domestic Product, Real Gross Domestic Product per capital, Exports as percentage of GDP (measures openness) , Annual rate of inflation based on consumer price index, Rate of adult illiteracy, Gross Fixed Capital Formation (as percent of GDP) , Telephone lines per 1000 people, liberalization. Their empirical analysis shows that growth rate of real GDP, export orientation (Openness), and liberalization, have positive impact on FDI. While else, macroeconomic instability and poor infrastructure have negative impact on FDI. Hence, they argue that liberalization of the trade and regulatory regimes, stable macroeconomic and political environment, and major improvements in infrastructure are essential to attract FDI to Ethiopia.

On the other hand, Ayelech and Helmsing (2010) on their work about the Ethiopian cut flower industry addressed the question to what extent a country benefits from the comparative

advantage in the long run in the view of the new industry, if foreign direct investment is the principal driving force. They further tried to assess whether the cut flower industry cooperates with or is accompanied by a process of development of domestic capabilities, a track which they denominated it to be "endogenisation". In Ethiopia, Dutch investors are the dominant players in this industry, which also accounts for the biggest share of the export trade auction. In addition, the Dutch development cooperation (DDC) plays a significant role in the development of the sector in the country.

They used a value chain framework to examine the industry and thereby develop plenty of indicators on the development direction. According to them, this framework provides a helpful tool through which to examine the effects of FDI in a country, and the direction of development in the industry concerned. The framework shows how each functional element in the production sequence involves transactions, and depends on technological and other inputs, including production technology and related research and development, and also transports logistics and communication processes. They formulated a set of indicators which includes, production, trading in export markets, and sectoral development. Based on their analysis, they conclude that endogenisation is a two-way process. And it depends both on the degree to which FDI has an interest to draw on domestic firms, enter into relationships and share technologies; and on the interest and ability of domestic firms to take up such opportunities, and on the creation of supporting institutions and infrastructures to make this take-up possible.

Furthermore, according to them, a few endogenisation spheres are happening in the country and, yet it for now is insignificant being at its initial stage. Much more specifically, there is a very few opportunity for the direct technological transfer from the Dutch direct investment in the horticulture sector. However, there is joint collective action on what they called non-core activities, mainly of the transportation; which accounts for the largest share in the total cost. And the Dutch cooperative flower auctions play a key role in giving an opportunity for the domestic growers to easily access the international market. They also stated Ethiopian entrepreneurial capacities as the main challenge and the lack of technical competence to meet growing competition in the industry locally.

3. An Over view of the Ethiopian Economy and the FDI operations

Ethiopia is a land locked country, located at the horn of Africa. Agriculture is the back bone of its economy; accounting for about 47 percent of the GDP and 85 percent of the labor force engage in this sector accounting for the greatest share of the total employment in the country. It is Africa's second most populous country. Privatization has taken place in many of the sectors, though some of the service sectors (Ethiopian Telecommunications, Financial and Insurance services, and Air and Land Transportation services) and the retail are owned by the government for a strategic reason. According to the 2013, Economic freedom index, Ethiopia's economic freedom score is 49.4, making its economy the 146th freest in the 2013 Index. The major export of the economy comes from coffee, which accounts for about 26.4% of the country's foreign exchange earnings. More about 25% of the total population engages in this cash crop production and marketing, making it one of the critical cash crops in the agricultural sector. Live animals, leather and leather products, chemicals, gold, pulses, oilseeds, flowers, fruits and vegetables and khat are some of the other domestic products penetrating the international market following the coffee. According to [7]the African Economic review, in the year 2012, Ethiopia's rate of economic growth was about 7% making it in the ninth ranking of the whole continent's growth. The growth was broad-based with an increasing role for services and industry and this momentum is expected to continue in 2013 and 2014, at a slower pace though.

Table 3.1: Major Economic Indicators for Ethiopia

Subject Descriptor	Units	Scale		2010	2011	2012	2013	2014	2015
Gross domestic product, current prices	U.S. dollars	Billions		29.684	31.715	41.906	46.306	49.715	54.407
Inflation, average consumer prices	Index			285.459	380.324	466.858	505.508	554.010	603.871
Volume of imports of goods and services	Percent change			14.713	-0.871	22.175	15.073	3.881	4.882
Current account balance	Percent of GDP			-4.021	0.634	-5.815	-7.524	-6.479	-6.535

Source: World Economic Outlook Database, April 2013

Attracting Foreign Direct Investment (FDI) being generally considered as an integral part of the development policy blend of successful emerging economies that leads the way to the required

http://en.wikipedia.org/wiki/Economy_of_Ethiopia
http://www.africaneconomicoutlook.org/en/countries/east-africa/ethiopia/

sustained economic transformation, Ethiopia is also following such a trend. Yet the share of the FDI relative to the GDP has remained to be to lower rate, and as a result the government's effort towards attracting foreign investors with promissory incentives to invest in the country is paramount. The trend in the global industrial redistribution is supposed to provide an opportunity for emerging African countries like Ethiopia to attract FDI and upgrade its economic structure. It has competitive advantage over the East Asian countries who had dominated the FDI attraction for the last three decades. Lower costs of land, relatively smooth regulatory compliance towards foreign direct investment, cheap cost of labor, privileged access to high-income markets, and growing domestic and regional markets are some of the advantages that the country has as an incentive for the foreign direct investment attritions. However, it is not that easy to attract all that flows from foreign investors, since there is strong competition from within lower income countries in Asia and other parts of the world, including Africa. And hence, it should promote itself as an alternative focal point for global companies to find new and favorable production centers with its competitive advantages.

Chorching, et al. (2012) identified four major reasons that attracts Chinese investors to Ethiopia. According to them, one is to take advantage of a good understanding of the investment climate gained from entrepreneurs' social networks. Secondly, to take advantage of the perceived opportunities provided by the current state of the Ethiopian economy; which includes the limited market capacity and market competition, cheap labor, cheap land, and an expanding Ethiopian market. Thirdly, the Chinese investors come to Ethiopia to maximize cross border investment incentives provided by the Ethiopian and Chinese governments. The incentive by the Ethiopian government includes tax holidays and tariff free policy for FDI equipment imports. And fourthly, is to make a strategic move of the parent company into the African market and to invest in favor of the stable political environment of Ethiopia. As far as the foreign investment is concerned, these principal reasons also work for the other foreign trade actors in the country.

Table.3.2 Distribution of FDI flows among economies

Range	Inflows	Outflows
Above $3.0 billion	Nigeria, Mozambique, South Africa, Democratic Republic of the Congo and Ghana	South Africa
$2.0 to $2.9 billion	Morocco, Egypt, Congo, Sudan and Equatorial Guinea	Angola and Libya
$1.0 to $1.9 billion	Tunisia, Uganda, United Republic of Tanzania, Algeria, Liberia, Mauritania and Zambia	Nigeria and Liberia
$0.5 to $0.9 billion	Ethiopia, Madagascar, Niger, Guinea, Sierra Leone, Gabon and Cameroon	..
$0.1 to $0.4 billion	Côte d'Ivoire, Zimbabwe, Mauritius, Namibia, Senegal, Chad, Mali, Botswana, Kenya, Lesotho, Togo, Rwanda, Benin, Malawi, Seychelles, Somalia and Djibouti	Democratic Republic of the Congo, Morocco, Egypt, Cameroon, Zambia and Togo
Below $0.1 billion	Swaziland, Gambia, Eritrea, Central African Republic, Cape Verde, São Tomé and Principe, Burkina Faso, Comoros, Guinea-Bissau, Burundi and Angola	Mauritius, Gabon, Sudan, Malawi, Senegal, Zimbabwe, Côte d'Ivoire, Kenya, Tunisia, Niger, Swaziland, Mali, Mauritania, Seychelles, Guinea, Ghana, Guinea-Bissau, Burkina Faso, São Tomé and Principe, Cape Verde, Namibia, Mozambique, Botswana, Lesotho, Algeria and Benin

Source: world investment report 2013, UNCTAD[8]

NB: The countries in the above table are listed according the scale of their foreign direct investment flows

The average annual FDI flows to Ethiopia from 2003 to 2006 were only 399 million dollars, which is only 1.56 percent of FDI flows into Africa. The country accounted for only 1 percent of the continent's inward FDI stock, while representing close to 9 percent of the population of the continent as whole. Ethiopia's per capita inflows were 5 dollars in 2006, lower than 39 dollars for African countries as a whole. FDI accounted for about 0.8 percent of the GDP in the year 2006, compared with 1.6 percent for African countries as a group. FDI flows to the country increased from an annual average of 131 million dollars in 1995-2000 to 312 million dollars in 2001-2006 although there are fluctuations in between. The unstable political environment of the country may be one of the reasons of the fluctuations. Ethiopia is one of the least industrialized economies in the world. Close to half a century, the industrial sector contribution to the GDP ranged between 9 and 11 percent, and the growth rate of the sector is very little compared to the

[8] http://unctad.org/en/PublicationsLibrary/wir2013_en.pdf

agricultural sector which takes accounts for the largest share. The employment contribution of the industrial sector is about 8 percentage points in 2005 according to the UNCTAD report, 2002.

Table 3.3: Cross-border merger and acquisition overview, 1995–2009

(Millions of dollars)

	Sales(net)				Purchases(net)			
Region/economy	1995-2005 (Annual average)	2007	2008	2009	1995-2005 (Annual average)	2007	2008	2009
Ethiopia	**6**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Memorandum								
Angola	18	-	- 475	- 471	-	- 60	-	-
Sudan	120	-	-	-	-	-	-	-
East Africa	121	484	76	29	- 285	89	291	191
Africa	3 064	8 076	21 193	5 140	1 685	9 891	8 216	2 702
Developing economies	40 624	100 381	104 812	39 077	25 868	144 830	105 849	73 975
World	357 132	1 022 725	706 543	249 732	357 132	1 022 725	706 543	249 732

Source: UNCTAD, World Investment Report 2010

Table 3.4: Countries ranking by Inward FDI performance Index and Inward FDI Potential Index, 2007–2009[9]

Economy	Inward FDI Performance			Economy	Inward FDI Potential Index		
	2007	2008	2009		2007	2008	2009
Yemen	89	56	127	Burkina Faso	129	129	..
Kenya	99	133	128	Congo, Democratic Republic of	132	130	..
Gabon	106	114	129	Niger	136	131	..
New Zealand	97	66	130	Malawi	137	132	..
Tajikistan	11	11	131	Togo	130	133	..
Ethiopia	**129**	**131**	**132**	**Ethiopia**	**131**	**134**	..
Nepal	139	136	133	Madagascar	133	135	..
Latvia	37	70	134	Guinea	134	136	..
Japan	134	129	135	Haiti	135	137	..
Kuwait	138	137	136	Benin	138	138	..
Slovakia	71	74	137	Rwanda	140	139	..

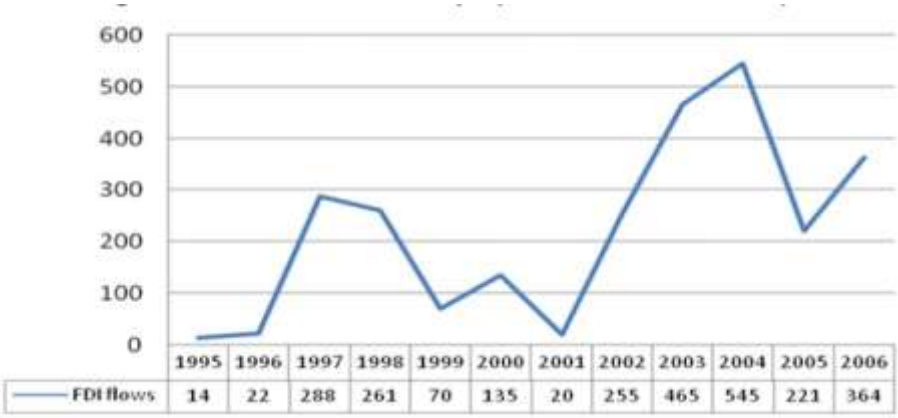
Source: UNCTAD, World Investment Report 2010

NB: Ranking is based on the latest data on hand for141 countries and the potential index is based on 12 economic and policy variables.

According to the UNCTAD report on the implementation of the investment policy [10]review (IPR), 2011, Ethiopia commenced an Industrial Strategy in the year 2003. The strategy, according to the report, mainly focused on three main sectors where it is believed that the country has comparative advantages; namely, the textile and garments, meat leather and leather products, and the agro-industry with numerous incentives to enhance the development of these sectors.

[9] http://unctad.org/sections/dite_dir/docs/wir10_fs_et_en.pdf
[10] http://unctad.org/en/Docs/diaepcb201007_en.pdf

Fig: 3: FDI Flows to Ethiopia (In Million of US Dollars)



Source: world investment report 2001, 2003, 2006 and2007, UNCTAD

4. Data Description and Methodology

4.1 Data Description

This paper is based on two main data sources. The first is the annual survey of manufacturing industries, conducted by the Ethiopian Statistical Agency. This large and medium scale manufacturing survey done by the CSA is confined to those establishments which engaged 10 persons and above and use power-driven machines and covers both public and private industries in all Regions of the country. The survey contains information on foreign ownership, *sales*, Total current paid-up capital, Total value of exported sales, total value of Imported raw Materials, inventories, employment, fixed assets, input costs, investment, and location for each category of industry based on the International Standard Industrial Classification (ISIC Revision-3.1) categorization. The Central Statistical Agency[11] (CSA) has been providing statistical information on the country's manufacturing and electricity industries since 1976 (1968 E.C.) annually, to alert policy interventionists on the changes taking place in the sector. The survey is the principal source of facts about the structure and function of the manufacturing industries in Ethiopia.

[11] http://www.csa.gov.et/

Additional data include the 2005/06 Ethiopia's Input Output Table and Social Accounting Matrix conducted by the Ethiopian Development Research Institute in collaboration with the Institute of Development Studies at the University of Sussex in 2009.

The data is of an unbalanced panel structure based on 8615 observations over the years 2004 to 2010.

Manufacturing industry is my focus of analysis and the CSA survey follows the following category of industry based on the International Standard Industrial Classification (ISIC Revision-3.1) categorization.

4.2 Methodology

In order to assess the vertical and horizoantal linkages in between the MNCs and Domestic firms and estimate the magnitude and direction of the effect, the paper employed pooled, Fixed and random Effect estimation techniques. A production function augmented for three basic spill over proxies: Horizontal, Backward and Forward; based on previous works on the area, like that of Javorcik (2004) and Blalock (2008,), is my baseline specification. Furthermore, in analyzing the inter- industry spill-over from the FDI I used a Panel framework with Levinsohn-Petrin approach developed by Levinsohn and Petrin (2003) for capturing the endogeneity problem residing in the standard OLS estimation of the production function. Different analytical testing, including unit root testing, co-integration testing, and Granger causality testing are applied in order to capture the causal backward and forward linkages.

4.3 Model Specification and Definition of Variables

Given, a log transformed Cobb–Douglas production function with the Backward and Forward spillover proxies in the form:

$$\ln Y_{it}=\alpha_1+\alpha_2 \ln M_{it}+\alpha_3 \ln E_{it}+\alpha_4 \ln L_{it}+\alpha_5 \ln K_{it}+ \alpha_6 FS_{it}+\alpha_7 Backward_{it}+ \alpha_8 Forward_{it}+ \alpha_t+ \alpha_j+ \alpha_r+\varepsilon_{it} \quad \ldots\ldots\ldots\

consumption of materials for the firm i, at time t; representing the value of material inputs adjusted for changes in material inventories, deflated by an intermediate inputs deflator calculated for each sector based on the input-output matrix and deflators for the relevant industries. $\mathbf{E_{it}}$ is the real energy consumption of the firm i at time t. **Lit** (LABOR) stands for the number of workers in the given firm i, in the given year. $\mathbf{K_{it}}$ represents the real net tangible capital at the end of the year showing the value of fixed assets at the end of the year. $\mathbf{FS_{it}}$ stands for the foreign share. It is a share of foreign capital in the firm's equity and attains values from zero to one. Following Javorcik (2004), I took firms with a foreign share of less than 0.2 to be domestic firms and those with foreign share of equal and more than 0.2 to be international firms. I accounted for a dummy, where FS_{it} is one if a firm is international or foreign, and zero otherwise.

In addition are the **three proxies for spillovers**: Horizontal, Backward and Forward that have been widely used in the literature of productivity spillovers, augmenting the coup Douglas Production function. One of these is the $\mathbf{Backward_{it}}$ variable which is an industry-level measure of a backward linkage of a given industry and it proxies the extent of potential linkages between local suppliers and transnational customers. Mathematically, it measures the percentage of output sold to multinational firms given us:

$\mathbf{Backward_{jt}}$ = the share of output that industry j sells to multinationals at time t.

$$Backward_{jt} = \sum_{k \text{ if } k \neq j} \alpha_{jk} \cdot Horizontal_{kt}$$

Where α_{jk} is the proportion of sector j's output supplied to industry k.

For example, consider that the chemical manufacturing industry sells half of its output to the food producers and half to the beverage industry. If no foreign producers are producing food items but half of all the beverage production comes from foreign affiliates, the Backward variable will be calculated as follows: 1⁄2*(0) +1⁄2*(1⁄2) =0.25

$\mathbf{Horizontal_{it}}$: captures the presence of multinational firms in given industries; measured as a share of output produced by international and foreign firms in total output of industry j at time t.

$$Horizontal_{jt} = \frac{\sum_{i \text{ for all } i \in j} FS_{it} \cdot Y_{it}}{\sum_{i \text{ for all } i \in j} Y_{it}}$$

Another variable of interest is the $Forward_{it}$. It proxies the share of inputs a given industry sources from multinationals. It is equal to the weighted share of output in supplying industries produced by firms with foreign capital. It is given by:

$$Forward_{it} = \delta_{jm} \sum_{m \text{ if } m \neq j} \left[\frac{\sum_{i\ for\ all \in m} Foreign\ Share_{it} * (Y_{it} - X_{it})}{\sum_{i\ for\ all \in m} (Y_{it} - X_{it})}\right]$$

Where, $\delta_{jm}$is the share of inputs purchased by industry j from industry m in total inputs purchased by industry j; excluding inputs purchased within the industry (X_{it}).

Note that, the proxies for horizontal and vertical linkages do change with time and the sector-specific variables; where the fixed one year coefficients from the Input-output matrix are combined with the varying foreign investment and output levels over years during their computation.

Hence, the production functions augmented for the proxies of the horizontal and vertical linkages following Javorcik (2004) follows:

$$\ln Y_{it} = \alpha_1 + \alpha_2 \ln M_{it} + \alpha_3 \ln E_{it} + \alpha_4 \ln L_{it} + \alpha_5 \ln K_{it} + \alpha_6 FS_{it} + \alpha_7 Horizontal_{it} + \alpha_8 Backward_{it} + \alpha_9 Forward_{it} + \alpha_t + \alpha_j + \alpha_r + \varepsilon_{it} \ldots\ldots\ldots\

under the analysis. Lags, First, and higher differences has also been used with this specification as we can see it in the estimation part (Chapter 5) that follows. Lags are considered in order to capture for the time that takes before the spillover manifests. Furthermore, the industry, time and regional dummies are taken under consideration to capture the hetrogiunity across the different groups of region, industry and time under consideration.

I have also used the extended production function with the interaction terms following Blalock (2008) stated as:

$$\ln Y_{it}=\alpha_1+\alpha_2 \ln M_{it}+\alpha_3 \ln E_{it}+\alpha_4 \ln Lit+\alpha_5 \ln K_{it}+ \alpha_6 \ln^2 M_{it}+\alpha_7 \ln^2 Eit+\alpha_8 \ln^2 Lit+\alpha_9 \ln^2 K_{it} +$$
$$\alpha_{10} \ln K_{it} \ln L_{it}+ \alpha_{11} \ln K_{it} M_{it} +\alpha_{12} \ln K_{it} E_{it}+ \alpha_{13} \ln L_{it} M_{it} +\alpha_{14} \ln L_{it} E_{it} +\alpha_{15} \ln M_{it}$$
$$E_{it}+\alpha_{16} FS_{it}+ \alpha_{17} Horizontal_{it} +\alpha_{18} Backward_{it}+ \alpha_{19} Forwardit+ \alpha_t+ \alpha_j+$$
$$\alpha_r+\varepsilon_{it} \ldots\ldots\ldots\

The data constitute an unbalanced Panel covering the period 2004 up to2010. Out of the total number of manufacturing firms surveyed per year, a low of seven hundred sixteen in 2005 to a high of one thousand eight hundred one in 2009 is taken as a sample; where I deleted those observations with zero sales, zero employment, and output; having a total of 9091 observation for all the seven years. The industries under consideration over those with NACE ISIC codes ranging in between 1511 to 3610. As for the categorization purpose, I categorized the firms with foreign capital participation of 20% share of subscribed capital (equity) owned by foreign investors under foreign; and the remaining as owned domestically. About eight percent of the total observations meet this definition. In addition to the CSA survey, I took a one year, 2006, EDRI[14] Input-Output matrix in drawing some of my interest variables in combination to the survey. Yet, it would have been better if I could get more than one input-output matrix for the relationships between sectors may change over time. However, the input-output matrix I got is the very first and only one done on an aggregate level, for the time being, for the later years are unavailable. Plus, given the common trend of matrix computation, there is an inclusion of imports, and for this sake of analysis; it would have been better if this could be avoided; which is not. Hence, the estimation results that follow should be interpreted with these two limitations in mind.

[14] http://www.edri-eth.org/Documents/SAM%20document%20with%20list%20of%20tables.pdf

Table 5.1.: Summary Statistics

Summary Statistics, using the observations 1:1 - 1801:7

Variable	All Firms		Domestic Firms	
	Mean	Std. Dev.	Mean	Std. Dev.
Current_paid_up_capital_Foregn	1.38948e+007	6.79691e+007	26595.9	306300.
Total_current_paid_up capital	1.82115e+007	9.64161e+007	1.70228e+007	9.67885e+007
Total_sales_value	1.48177e+007	6.42056e+007	1.34954e+007	6.09620e+007
Total_value_of_exported_sales	1.74296e+007	3.38722e+007	1.70500e+007	3.37729e+007
Total_value_of_Imported_raw_mat	4.73741e+006	1.96722e+007	4.42976e+006	1.94339e+007
Eit	9.79724e+006	3.39974e+007	9.02391e+006	3.25335e+007
LABOR	72.6445	214.866	68.2053	206.212
Kit	6.34206e+006	2.93330e+007	5.97531e+006	2.84919e+007
Mit	6.88330e+006	2.32147e+007	6.44111e+006	2.28454e+007
Yirt	1.48272e+007	6.38116e+007	1.35834e+007	6.12741e+007
FSirt	0.0652029	0.234830	0.000246135	0.00534941
Horizontal	0.116190	0.162428	0.109157	0.153020
Backward	0.0138201	0.0349822	0.0131209	0.0309475
Forward	0.0164196	0.0336916	0.0164022	0.0336196
Tax	3.01169e+006	1.49116e+007	2.92101e+006	1.48282e+007
Demand	8.25327e+008	1.07727e+010	7.37497e+008	9.86262e+009
H	4.46839e+032	8.11716e+033	3.32624e+032	6.99442e+033

As we can see from the summary statistics below (table 5.3), the proxy variables show some oscillatory trend since the years under consideration fall in those with the occurrence of the economic crisis that took place since 2007. For it is the case that the economic crisis affected the developing countries like that of Ethiopia lesser, yet; the spillover effect from the multinationals to contribute for the crisis's fast transmission is considerably high. The Horizontal variable increased from 7.8% in 2004 to about 12% in 2006 and then followed a decreasing trend in the

years 2007; then revived back to 22% in 2010. Likewise, the backward variable stayed stable to about 2% level in the years 2004 and 2005 and showed a declining trend in the years that follow and revived back to 2% in 2010. The highest Backward variable record was from the food industry with a 4.6% in the year 2005, followed manufacturing of metal products and Manufacture of flour with 3.6% and 1.5% respectively. The Forward variable increased from 2% in 2004 to 3% in 2010; with a significant fall and oscillation in the years in between. The highest forward variable record was from the Food industry followed by Manufacture of furniture with a 13.6% and 13.5% records respectively.

Table 5.2 Summary statistic for the Proxy variables over years

Year	No of industries (ISIC 1511 up to 3610)	Horizontal		Backward		Forward	
		Mean	St.dev.	Mean	St.dev.	Mean	St.Dev.
2004	21	0.078493	0.10847	0.021096	0.043946	0.024889	0.035787
2005	21	0.091774	0.15335	0.024655	0.056936	0.0050512	0.0088171
2006	21	0.12864	0.12547	0.015821	0.038991	0.0082333	0.010939
2007	21	0.063562	0.19679	0.0073755	0.012240	0.0074061	0.0098095
2008	21	0.067863	0.18642	0.0069596	0.032756	0.0061469	0.045404
2009	21	0.085246	0.023007	0.0049940	0.015743	0.023605	0.048876
2010	21	0.22376	0.11300	0.022300	0.010938	0.032298	0.010718

Fig 4: Scatter Plot for the Spillover Proxies and the total out put

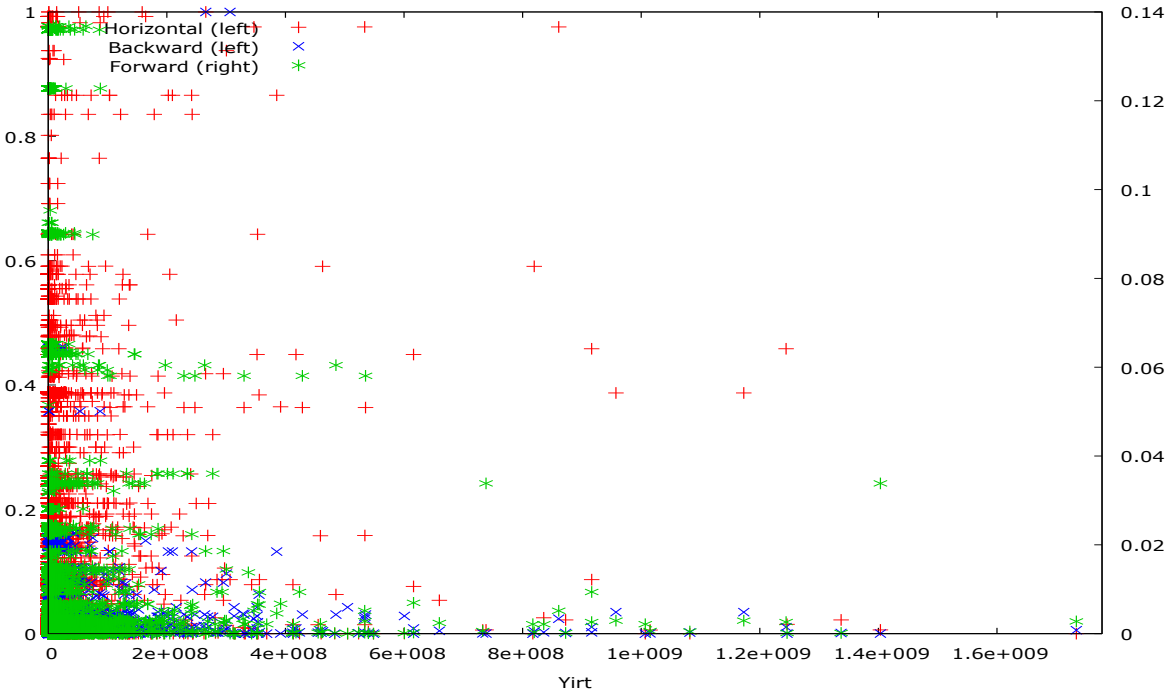
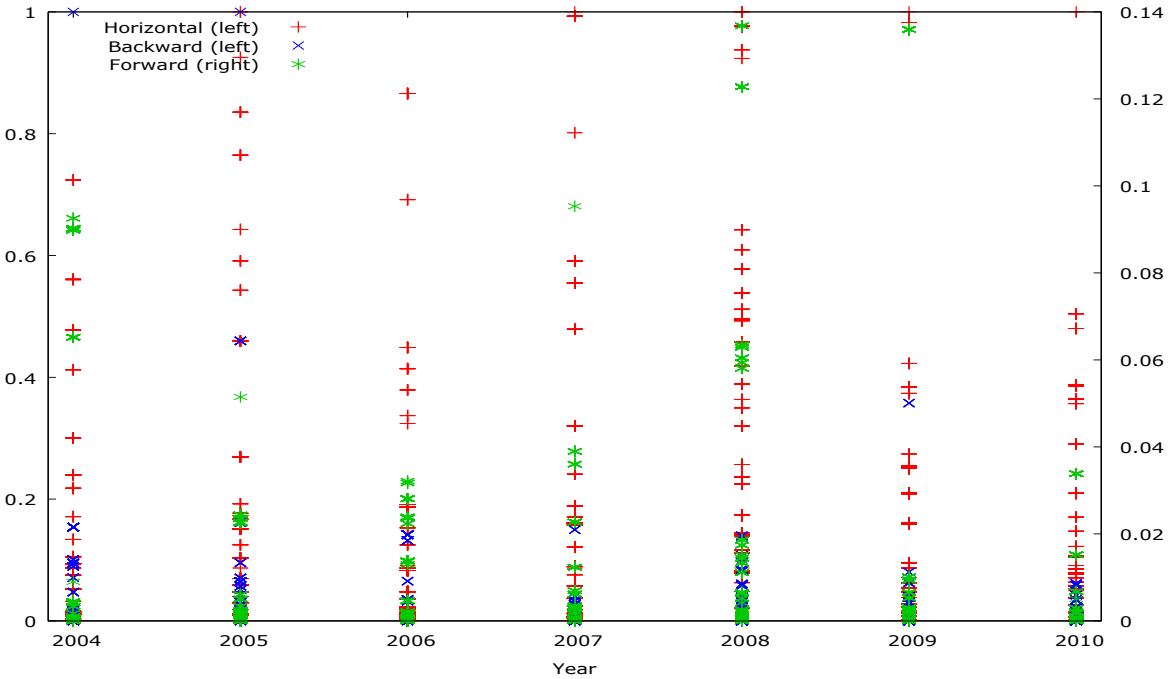


Fig 5: Scatter Plot for the Spillover Proxies over years



In the regression that follows, I estimated the specification which was stated in the model above using pooled Ordinary least squares (OLS), Fixed Effect and Random Effect models for the panel data. A firm's output (Y_{it}) is the dependent variable. Capital (K_{it}), LABOR, Materials (Mit), Foreign Share (FS_{it}), and the proxies for FDI spillovers: Horizontal, Backward, and Forward are the explanatory variables. Furthermore, I also incorporated in the model, Six Time dummies, Twenty Industry Dummies and Fourteen Regional Dummies in order to take in to account for the heterogeneity across years, industries and regions. These is because, there might exist Industry-, time-, and region-specific factors unknown to for us econometrically, and yet known to the firm that might affect productivity of the firm. For example, administrative performance in a particular firm or better infrastructure in a given region or attractiveness of a given region/industry can be some of such factors; and the operational dummies stated here will solve the problem to some extent. Based on the previous works and the existing reality that the knowledge externalities from the foreign presence may take time to manifest themselves, I employed both contemporaneous and with lagged spillover variables for my estimation. For the sake of comparison purpose, I run the regressions for both the domestic and all samples.

Table 5.3: Pooled OLS estimation both for all and domestic firms: Pooled OLS, using 8655 observations, Included 1800 cross-sectional units

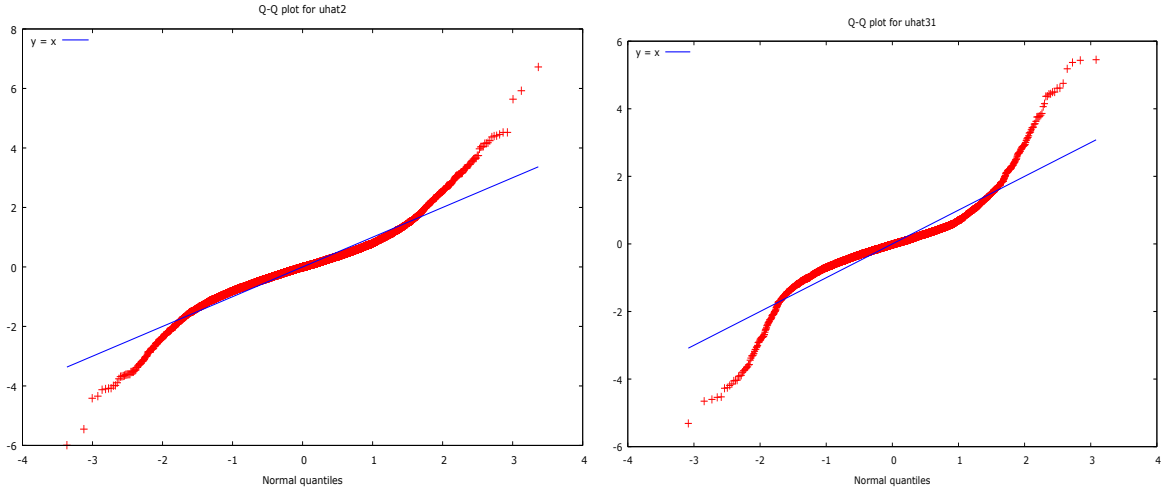
Time-series length: minimum 1, maximum 7

Dependent variable: l_Yirt

	All Firms			***Domestic Firms***		
	Coefficient	***Std. Error***		***Coefficient***		***Std. Error***
Const	4.36528	0.988014	***	3.58952	***	0.0974539
l_Eit	0.450411	0.0417276	***	0.41059	***	0.0415892
l_LABOR	0.2544	0.0123583	***	0.230858	***	0.0124356
l_Kit	0.134285	0.00630535	***	0.13959	***	0.00636519
l_Mit	0.143053	0.0432084	***	0.197509	***	0.0426984
FSirt	0.187674	0.0515658	***	1.0864	**	2.2298
Horizontal	0.0338789	0.0878477		-0.187669	***	0.0925696
Backward	0.345473	0.381755		0.288344		0.42623
Forward	-0.978073	0.465506	**	-1.20264		0.438914

All Firms	Mean dependent var	14.15670	S.D. dependent var	2.139720
	Sum squared resid	6596.275	S.E. of regression	0.981950
	R-squared	0.833518	Adjusted R-squared	0.789397
Domestic Firms	Mean dependent var	14.15539	S.D. dependent var	2.111678
	Sum squared resid	6064.442	S.E. of regression	0.972672
	R-squared	0.788296	Adjusted R-squared	0.787833

Fig 6: Residual Q-Q Plots



(a) All Firms (b) Domestic Firms

Table 5.4 presents pooled OLS estimation results both for the domestic and all firms. As we can see from the result, I found a significant and negative coefficient on the Forward Variable for the whole sample, which is consistent with the previous findings. Yet, I have not found any significant effect from the Backward and Horizontal variables for the sample under consideration. On the other hand, the coefficient for the Horizontal variable is negative and significant for the domestic firms.

In order to avoid omitted variable bias from my work, I took in to account for some other factors that might affect the productivity of the firm; which will help me to isolate the net effects of the productivity spillovers. For example, provided the smooth entry to the market within the specified period; a multinational entry to the market will to some extent decrease the industry's concentration. This on the other hand will lead to a more competition; forcing domestic firms to improve their efficiency. Hence, we can recognize a spillover effect on the productivity which comes from such a situation. And we need to separate this effect from the gross effect, in order to identify the net effect from that of the knowledge transfer by separating the two. To this effect, following Javorcik (204), I accounted for the Herfindahl index as a proxy for the level of market concentration.

Furthermore, foreign entry into downstream sectors may increase demand for intermediate products. And this results for the local suppliers to reap the benefits of economies of scale with an increase in the demand. And again, to separate this effect, I included the demand for intermediates in my specification. The Demand variable is drawn from the information on sourcing patterns in the IO matrix and the value of production in the input using sectors. Following such specification (Table 5.4), I found, a positive and significant Backward variable, and a negative and significant Forward variable in line with the previous works. The specification describes the problem well, as can be seen from the Adjusted R^2 of about 78%. Hence, my analysis suggests that a one percentage point increase in the foreign presence in the downstream sectors is associated with the 0.7 percent rise in output of each supplying industries. And likewise, a one-standard deviation increase in the weighted share of output in the upstream (or supplying) sectors produced by firms with foreign capital participation is associated with the 1.6 percent decline in total output.

Table 5. 4: Pooled OLS for all Firms, with additional variables "Demand" and "Herfinail Index"

Pooled OLS, using 8655 observations

Included 1800 cross-sectional units

Time-series length: minimum 1, maximum 7

Dependent variable: l_Yirt

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	3.4118	0.120843	28.2333	<0.00001	***
l_Eit	0.416817	0.0368654	11.3064	<0.00001	***
l_LABOR	0.259022	0.0110173	23.5105	<0.00001	***
l_Kit	0.14509	0.00565379	25.6624	<0.00001	***
l_Mit	0.160305	0.0379313	4.2262	0.00002	***
l_Demand	0.0250015	0.00483143	5.1748	<0.00001	***
H	0	0	2.0532	0.04009	**
FSirt	0.171148	0.0470638	3.6365	0.00028	***
Horizontal	-0.0819612	0.0801889	-1.0221	0.30676	
Backward	0.710691	0.342668	2.0740	0.03811	**
Forward	-1.56484	0.358201	-4.3686	0.00001	***

Mean dependent var	14.15670	S.D. dependent var	2.139720
Sum squared resid	8737.515	S.E. of regression	1.005744
R-squared	0.779475	Adjusted R-squared	0.779067

5.1 Simultaneity Problem with the OLS estimation

Given the log-transformed Cobb–Douglas production function, as the one in our model, without the proxies; there happens a so called of the simultaneity problem in which the firm recognizes at least a part of the total factor productivity (TFP) at a point in time early enough allowing the firm to alter its factor input decision. In that case, then profit maximization motive of the firm implies that the existence of the error term of the production function is expected to affect the choice its of factor inputs, at the micro level. Consequently, this implies that the explanatory variables and the error term are correlated, accounting for the endogineity problem in the estimate. Hence, this makes the OLS estimates for this case to be biased. One of the remedies for such problem with the OLS is the usage of Fixed-effect estimation techniques will solve the problem and deliver consistent estimates of the parameters. Therefore, in the analyses that follow, I present the fixed effect estimation results. In the same way, I found a negative significant coefficient for the Backward variable in the estimation in both the original specification and the regression with

additional ‘Demand’ and ‘H’ variables. The coefficient for the Horizontal variable is found to be negative and significant in the second specification. (See Tables 5.5 and 5.6)

Table 5.5: Fixed-effects estimation for all firms

Fixed-effects, using 8655 observations
Included 1800 cross-sectional units
Time-series length: minimum 1, maximum 7
Dependent variable: l_Yirt

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	3.37927	0.0866316	39.0074	<0.00001	***
l_Eit	0.358302	0.0402238	8.9077	<0.00001	***
l_LABOR	0.212575	0.0110699	19.2029	<0.00001	***
l_Kit	0.142706	0.00629708	22.6622	<0.00001	***
l_Mit	0.251793	0.0415185	6.0646	<0.00001	***
FSirt	0.20609	0.0519934	3.9638	0.00007	***
Horizontal	-0.0147596	0.081621	-0.1808	0.85651	
Backward	0.331439	0.376402	0.8805	0.37860	
Forward	-1.14356	0.423792	-2.6984	0.00698	***

Mean dependent var	14.15670	S.D. dependent var	2.139720
Sum squared resid	6721.878	S.E. of regression	0.990821
LSDV R-squared	0.830348	Within R-squared	0.766545

Table 5.6: Fixed-effects estimation for all firms, with additional variables “Demand” and “Herfinail Index”

Fixed-effects, using 7984 observations
Included 3 cross-sectional units
Time-series length: minimum 2633, maximum 2678

Dependent variable: l_Yirt

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	3.44289	0.126615	27.1918	<0.00001	***
l_Eit	0.466644	0.0398183	11.7193	<0.00001	***
l_LABOR	0.249713	0.0115731	21.5769	<0.00001	***
l_Kit	0.145146	0.00592926	24.4795	<0.00001	***
l_Mit	0.112051	0.0410797	2.7276	0.00639	***
l_Demand	0.0229075	0.00508137	4.5081	<0.00001	***
H	0	0	1.5492	0.12136	
FSirt	1.21759	2.07934	0.5856	0.55818	
Horizontal	-0.198811	0.0884109	-2.2487	0.02456	**
Backward	0.48064	0.407516	1.1794	0.23826	
Forward	-1.68008	0.385061	-4.3632	0.00001	***

Mean dependent var	14.08264	S.D. dependent var	2.114036
Sum squared resid	8027.442	S.E. of regression	1.003912
LSDV R-squared	0.774998	Within R-squared	0.753051

In the Table 5.7 below, in order to capture the element of spillovers with flexibility to adjust for the changes in a previous year, since the knowledge externalities from the foreign presence may take time to manifest themselves, I employed estimation with lagged spillover variables. The coefficients on lagged values for the Forward variable appear to be larger (in the absolute value) and still consistently significant. Yet the Horizontal and Backward variables do not appear to be statistically significant.

Table 5.7: Fixed-effects estimation with one lag

Fixed-effects, using 6702 observations

Included 1771 cross-sectional units

Time-series length: minimum 1, maximum 6

Dependent variable: l_Yirt

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	3.60798	0.109453	32.9637	<0.00001	***
l_Eit	0.442432	0.0468991	9.4337	<0.00001	***
l_LABOR	0.289266	0.015478	18.6889	<0.00001	***
l_Kit	0.134406	0.00773498	17.3764	<0.00001	***
l_Mit	0.143165	0.0482614	2.9664	0.00303	***
FSirt_1	-0.0404057	0.0628459	-0.6429	0.52030	
Horizontal_1	0.00924632	0.0927037	0.0997	0.92055	
Backward_1	-0.666437	0.413646	-1.6111	0.10722	
Forward_1	-2.60823	0.629438	-4.1437	0.00003	***

Mean dependent var	14.36717	S.D. dependent var	2.151128
Sum squared resid	5291.172	S.E. of regression	1.036719
LSDV R-squared	0.829360	Within R-squared	0.744754

In addition to considering the time, regional and industry dummies, differencing can also help reduce the influence of noises arising from the unobserved heterogeneity in the analysis. Differencing helps to take away any fixed firm-specific, industrial and regional unobservable variations; for example, infrastructure and technological opportunity in a given industry or region. Hence, our specification follows,

$$\Delta \ln Y_{it}=\alpha_1+\alpha_2\Delta \ln M_{it}+\alpha_3\Delta \ln E_{it}+\alpha_4\Delta \ln L_{it}+\alpha_5\Delta \ln K_{it}+\alpha_6\Delta FS_{it}+\alpha_7\Delta Horizontal_{it}$$
$$+\alpha_8\Delta Backward_{it}+\alpha_9\Delta Forward_{it}+\alpha_{10}\Delta H\alpha_t+\alpha_9\Delta \ln Demand+\alpha_t+\alpha_j+$$
$$\alpha_r+\varepsilon_{it}\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(4)$$

The estimation based on equation (4) above is presented in the following table 5.8. 5 in the first, second and third difference form. According to Javorcik (2004), the examination of higher differences gives relatively more weight to more persistent changes in the variables of interest

and hence reduces the effect of the noise; yet, it decreases the sample size. Here, I found a positive and significant coefficient for the Horizontal variable in the 2nd and 3rd difference estimations. As for the first difference estimation, both the Backward and forward variables are found to be statistically significant; where both attained a positive coefficient in the first differencing. And also, the coefficients attain higher magnitude with the differencing. Unlike the previous estimations, the R^2 and adjusted R^2 of the model with the differencing have relatively increased. This implies that the model with the differencing better explains the percentage variation in the productivity of the firm.

Note that: in the table that follows; d' stands for first difference, d'' on the table that follows stand for second difference and d''' for the third difference.

Table 5.8: Fixed Effect estimation in First, second and third Differences with additional variables: "Demand" and "H"

	Coefficient	***Std. Error***	***t-ratio***	***p-value***	
Const	0.0927914	0.0231288	4.0119	0.00006	***
d_l_Eit	0.226725	0.0591531	3.8328	0.00013	***
d_l_LABOR	0.197831	0.0173699	11.3893	<0.00001	***
d_l_Kit	0.118302	0.00937703	12.6162	<0.00001	***
d_l_Mit	0.436962	0.0618414	7.0658	<0.00001	***
d_l_Tax	0.00393225	0.00744931	0.5279	0.59764	
d_l_Demand	0.0227004	0.00903953	2.5112	0.01210	**
d_H	0	0	2.5674	0.01031	**
d_FSirt	0.223473	0.0698986	3.1971	0.00141	***
d_Horizontal	0.0851554	0.11171	0.7623	0.44597	
d_Backward	1.1827	0.46631	2.5363	0.01127	**
d_Forward	2.58961	0.88394	2.9296	0.00343	***
const	-0.0058936	0.0554908	-0.1062	0.91542	
d''Eit	0.133669	0.0428364	3.1205	0.00182	***
d''LABOR	0.236339	0.0131142	18.0216	<0.00001	***

d''Kit	0.0735107	0.00641726	11.4551	<0.00001	***
d''Mit	0.589171	0.0445777	13.2167	<0.00001	***
d''Demand	0.00213263	0.00556055	0.3835	0.70136	
d''H	0	0	3.1817	0.00148	***
d''FSirt	0.124522	0.0468386	2.6585	0.00789	***
d''Horizontal	0.290117	0.0777745	3.7302	0.00019	***
d''Backward	0.441879	0.319121	1.3847	0.16625	
d''Forward	0.230284	0.820003	0.2808	0.77886	
const	0.0678736	0.196206	0.3459	0.72952	
d'''Eit	-0.0114183	0.0975223	-0.1171	0.90683	
d'''LABOR	0.221815	0.027667	8.0173	<0.00001	***
d'''Kit	0.0579484	0.0132491	4.3738	0.00001	***
d'''Mit	0.77758	0.101431	7.6661	<0.00001	***
d'''Tax	-0.00479025	0.0100494	-0.4767	0.63378	
d'''Demand	-0.00178442	0.0112321	-0.1589	0.87383	
d'''H	0	0	0.8912	0.37320	
d'''FSirt	0.155345	0.092624	1.6772	0.09405	*
d'''Horizontal	0.389071	0.174077	2.2351	0.02579	**
d'''Backward	0.23685	0.58119	0.4075	0.68377	
d'''Forward	1.19651	1.62853	0.7347	0.46281	

1st Difference	LSDV R-squared	0.942426	Within R-squared	0.923609
2nd Difference	LSDV R-squared	0.916909	Within R-squared	0.905330
3rd Difference	LSDV R-squared	0.874053	Within R-squared	0.839072

Table 5.9 Estimation with interaction terms following Blalock (2008)

Pooled OLS, using 4567 observations

Included 3 cross-sectional units

Time-series length: minimum 1326, maximum 1653

Dependent variable: l_Yirt

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	3.97186	0.563052	7.0542	<0.00001	***
l_Eit	-3.58949	0.387912	-9.2534	<0.00001	***
l_LABOR	0.239436	0.0973948	2.4584	0.01399	**
l_Kit	0.0378692	0.0496879	0.7621	0.44602	
l_Mit	4.21682	0.404075	10.4357	<0.00001	***
l_Tax	-0.00406258	0.00499368	-0.8135	0.41595	
l_Demand	0.0205019	0.00657989	3.1158	0.00185	***
sq_l_Eit	0.328429	0.0293971	11.1721	<0.00001	***
sq_l_Kit	0.0143023	0.00156992	9.1102	<0.00001	***
sq_l_LABOR	0.019012	0.00783126	2.4277	0.01523	**
sq_l_Mit	-0.0900343	0.0286243	-3.1454	0.00167	***
lnKitlnLABOR	0.0240283	0.0065558	3.6652	0.00025	***
lnKitlnMit	0.122306	0.0260293	4.6988	<0.00001	***
lnKitlnEit	-0.143613	0.0257913	-5.5683	<0.00001	***
lnLABORlnMit	0.0661837	0.049993	1.3239	0.18562	
lnLABORlnEit	-0.0997564	0.0484017	-2.0610	0.03936	**
lnMitlnEit	-0.22879	0.0458842	-4.9862	<0.00001	***
FSirt	0.581299	2.59873	0.2237	0.82301	
Horizontal	-0.336473	0.109473	-3.0736	0.00213	***
Backward	0.945996	0.492094	1.9224	0.05462	*
Forward	-0.425878	0.533846	-0.7978	0.42505	

Mean dependent var	14.12935	S.D. dependent var	2.094282
Sum squared resid	4230.711	S.E. of regression	0.965337
R-squared	0.788745	Adjusted R-squared	0.787535

Fixed-effects, using 4567 observations

Included 3 cross-sectional units

Time-series length: minimum 1326, maximum 1653

Dependent variable: l_Yirt

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	3.97891	0.564208	7.0522	<0.00001	***
l_Eit	-3.65328	0.389043	-9.3904	<0.00001	***
l_LABOR	0.220453	0.0976374	2.2579	0.02400	**
l_Kit	0.0466126	0.0497694	0.9366	0.34903	
l_Mit	4.27564	0.404843	10.5612	<0.00001	***
l_Tax	-0.00381924	0.00499241	-0.7650	0.44431	
l_Demand	0.0218105	0.00660239	3.3034	0.00096	***
sq_l_Eit	0.324315	0.029433	11.0188	<0.00001	***
sq_l_Kit	0.0140087	0.00157701	8.8831	<0.00001	***
sq_l_LABOR	0.0184153	0.00783468	2.3505	0.01879	**
sq_l_Mit	-0.102362	0.0289939	-3.5305	0.00042	***
lnKitlnLABOR	0.0248868	0.00656265	3.7922	0.00015	***
lnKitlnMit	0.120032	0.0260361	4.6102	<0.00001	***
lnKitlnEit	-0.141721	0.0257912	-5.4949	<0.00001	***
lnLABORlnMit	0.0762959	0.0501094	1.5226	0.12793	
lnLABORlnEit	-0.10893	0.0484995	-2.2460	0.02475	**
lnMitlnEit	-0.212288	0.0462725	-4.5878	<0.00001	***
FSirt	0.711195	2.59775	0.2738	0.78427	
Horizontal	-0.283378	0.111224	-2.5478	0.01087	**
Backward	0.824246	0.494002	1.6685	0.09528	*
Forward	-0.537601	0.54804	-0.9810	0.32667	

Mean dependent var	14.12935	S.D. dependent var	2.094282
Sum squared resid	4224.062	S.E. of regression	0.964790
LSDV R-squared	0.789077	Within R-squared	0.770077

Using equation three from the model specification part, given as:

$$lnY_{it}=\alpha_1+\alpha_2 lnM_{it}+\alpha_3 lnE_{it}+\alpha_4 lnLit+\alpha_5 lnK_{it}+ \alpha_6 ln^2M_{it}+\alpha_7 ln^2Eit+\alpha_8 ln^2Lit+\alpha_9 ln^2K_{it} + \alpha_{10} lnK_{it}\, lnL_{it}+ \alpha_{11} lnK_{it}M_{it} +\alpha_{12} lnK_{it}\, E_{it}+ \alpha_{13} lnL_{it}M_{it} +\alpha_{14} lnL_{it}\, E_{it} +\alpha_{15} lnM_{it}\, E_{it}+\alpha_{16} FS_{it}+ \alpha_{17} Horizontal_{it} +\alpha_{18} Backward_{it}+ \alpha_{19} Forwardit+ \alpha_t+ \alpha_j+ \alpha_r+\varepsilon_{it} \ldots\ldots\ldots\

can also solve the [15]simultaneity problem residing in the estimation of the production function. Therefore, with this advantage of the LP over the OP and for the purpose of ease of operation in STATA, with the Stata extension called levpet; I here will be using the Levinsohn and Petrin approach.

$$\mathbf{lnY_{it}=\alpha_1+\alpha_2 lnL_{it}+\alpha_3 lnK_{it}+\alpha_3 lnM_{it}+\omega_{It}+\eta_{It}} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\mathbf{(5)}$$

The error term has two components: ω_t and η_t. ω_t is unobserved a state variable affects the firm's decision rules and the choices of inputs, resulting in a simultaneity problem of the estimation of the production. Hence, Demand for the intermediate input M_t is assumed to depend on the firm's state variables Kt and ωt stated as:

$$\mathbf{M_t = M_t\ (K_t\ ,\ \omega t\ )} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\mathbf{(6)}$$

Making mild assumptions about the firm's production technology, Levinsohn and Petrin (2003) show that the demand function is monotonically increasing in ωt; allowing the inversion of the intermediate demand function. Therefore, ω_t can be written as a function of K_t and M_t as:

$$\mathbf{\omega_t = \omega_t\ (K_t,\ M_t\ )} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\mathbf{(7)}$$

Therefore, in the equation (5) above, the unobservable productivity term($\mathbf{\omega_t}$) is expressed as a function of two observed inputs

LP assume that productivity is governed by a first order Markov process

$$\mathbf{\omega t = E[\omega_t|\omega_{t-1}] + \epsilon_t} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\

Table 5.11 Pooled OLS, Dependent variable: l_Yirt

OLS with constant	***Coefficient***	***Std. Error***	***t-ratio***	***p-value***	
const	3.35865	0.0751545	44.6899	<0.00001	***
l_LABOR	0.224422	0.0106162	21.1396	<0.00001	***
l_Kit	0.159509	0.00578493	27.5733	<0.00001	***
l_Mit	0.597301	0.00714669	83.5773	<0.00001	***
Sum of Coefficients	4.339882				
R-squared	0.768209	Adjusted R-squared		0.768123	
OLS without constant	**Coefficient**	**Std. Error**	**t-ratio**	**p-value**	
l_LABOR	0.0623914	0.0111513	5.5950	<0.00001	***
l_Kit	0.23675	0.00616993	38.3716	<0.00001	***
l_Mit	0.80565	0.00605361	133.0860	<0.00001	***
Sum of Coefficients	1.1047914				
R-squared	0.993615	Adjusted R-squared		0.993613	

Using the levpet command from the stata extension of LP, the LP estimation result is presented as in the table 5.12 below. I used the output ([16]Gross revenue) as a dependent variable with a 250 bootstrap.

Table 5.12 Levinsohn-Petrin productivity estimator

Dependent variable represents revenue. Number of obs = 8915

Group variable (i): Firm Number of groups = 1801

Time variable (t): Year Obs per group: min = 1

avg = 5.0

max = 7

[16] http://www.econ.umn.edu/~petrin/papers/petrin_poi_levinsohn_stata.pdf

----

lnYirt | Coef. Std. Err. z P>|z| [95% Conf. Interval]

-------------+--

lnLABOR | .1973301 .0119441 16.52 0.000 .1739201 .2207401

lnKit | .0946624 .0255111 3.71 0.000 .0446617 .1446632

lnMit | .7337455 .0478269 15.34 0.000 .6400065 .8274844

Wald test of constant returns to scale: Chi2 = 1.09 (p = 0.2973).

Hence, from the Wald test of constant returns to scale; we reject the null that the sum of the coefficients equals one at a 5% significance level. The estimation is done on 250 bootstrap [reps (250)] replications, provided that larger bootstrap gives me a better fitting result econometrically.

5.2 Comparison of OLS, fixed effects, and Levinsohn-Petrin estimators

Now, I will derive the expected directions of bias on the OLS estimates as compared to the LP's intermediate input approach when simultaneity exists and compare the estimates.

Table 5.13: Comparison of OLS, fixed effects, and Levinsohn-Petrin estimators

Variables	**OLS with constant**	**OLS without constant**	**Fixed Effects**	**Levinsohn-Petrin**
const	3.35865 (0.0751545)	-	3.38984 (0.0792556)	-
logLABOR	0.224422 (0.0106162)	0.0623914 (0.0111513)	0.224107 (0.0106199)	0.1973301 (0.0119441)
logKit	0.159509 (0.00578493)	0.23675 (0.00616993)	0.157788 (0.00586734)	0.0946624 (0.0255111)
logMit	0.597301 (0.00714669)	0.80565 (0.00605361)	0.596698 (0.00724773)	0.7337455 (0.0478269)

Sum of Coefficients	4.339882	1.1047914	4.368433	1.025738

As can be seen from the sum of the coefficients, all the estimation techniques present an increasing returns to scale. For the estimates on the freely variable inputs, the OLS coefficients in all the three cases exceed the Levinsohn-Petrin coefficient, in line with the Levinsohn and Petrin's (2003) findings Yet, for the proxy variable Material Inputs (logMit), the Levinsohn-Petrin coefficient is greater than both OLS with intercept and the fixed effect. Whether the OLS coefficient on capital (logKit) will be biased upward or downward depends on the degree of correlation among the inputs and the productivity shocks. Here, LP estimate is less than all; and hence, the OLS and Fixed Effect estimates are biased upward as can be seen in the table below.

Table 5.14

Variables	**OLS with constant**	**OLS without constant**	**Fixed Effects**	**Levinsohn-Petrin**
ΔlogLABOR	0.224422 +	0.0623914 +	0.224107 +	baseline (0.1973301)
ΔlogKit	+	+	+	Baseline (0.0946624)
ΔlogMit	-	+	-	Baseline (0.7337455)

5.3 Levinsohn-Petrin Residuals as a Measure of Total Factor Productivity

After the LP estimation of the production function on equation (4), I recovered residuals and used these residuals as a measure of total factor productivity (TFP). Then, the TFP drawn is used in place of output as a dependent variable in the basic production function augmented for the spillover proxies as:

$$\ln TFP_{it} = \alpha_1 + \alpha_2 FS_{it} + \alpha_2 Horizontal_{it} + \alpha_3 Backward_{it} + \alpha_4 Forward_{it} + \varepsilon_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots (9)$$

In order to test for productivity spillovers, I estimated the model using both the fixed and random effect methods. Table 5.15 and 5.16 bellow present the estimation results. I found a negative and significant coefficient for the forward variable in both the random and fixed effect estimations. And, a positive and statistically significant coefficient for the backward variable. My TFP analysis (Table 5.16) suggests that a one percentage point increase in the foreign presence in the downstream sectors is associated with the 1.1 percent increase in the total factor productivity of each supplying industries. Likewise, a one percentage point increase in the weighted share of output in the upstream (or supplying) sectors produced by firms with foreign capital participation is associated with the 1.2 percent decline in the total factor productivity. The coefficient on of Horizontal variable is not statistically significant in both the Random and fixed effect analysis of the TFP. This actually is consistent with the existing studies that did not find significant horizontal spillovers in developing countries, like that of Aitken and Harrison and Konings) and the same hold for the developing country like Ethiopia.

Table 5.15: Fixed-effects (Dependent variable: l_TFP)

	All Firms		Domestic Firms	
	Coefficient		*Coefficient*	
const	-1.29248	***	-1.37419	***
FSirt	0.00268061		7.92313	
Horizontal	-0.115453		0.0360192	
Backward	1.62979	*	2.24246	**
Forward	0.38181		0.699874	
LSDV R-squared	0.395126		LSDV R-squared	0.418975
Within R-squared	0.010548		Within R-squared	0.014552

Table 5.16: Random-effects (GLS), using 4109 observations (Dependent variable: l_TFP)

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	-1.23914	0.0543274	-22.8088	<0.00001	***
FSirt	0.0885554	0.086289	1.0263	0.30483	
Horizontal	-0.195057	0.147817	-1.3196	0.18705	
Backward	1.13372	0.604281	1.8761	0.06071	*
Forward	-1.20446	0.646241	-1.8638	0.06242	*

Mean dependent var	-1.081443	S.D. dependent var	1.330256
Sum squared resid	7200.907	S.E. of regression	1.325262
Log-likelihood	-6983.049	Akaike criterion	13986.10
Schwarz criterion	14049.31	Hannan-Quinn	14008.47

Now, let us see the model in first differences in the form.

$$\Delta \ln TFP_{it} = \alpha_1 + \alpha_2 \Delta FS_{it} + \alpha_2 \Delta Horizontal_{it} + \alpha_3 \Delta Backward_{it} + \alpha_4 \Delta Forward_{it} + \mu_{it} \ldots (10)$$

Table 5.17: Fixed-effects, Dependent variable: l_TFP

	All Firms		Domestic Firms	
	Coefficient		*Coefficient*	
const	-1.25924	***	-0.0473625	
d_FSirt	-0.0500116		-0.0896258	
d_Horizontal	-0.0171907		-0.211749	*
d_Backward	1.24329	*	0.106416	
d_Forward	-0.189924		-1.38817	
LSDV R-squared 0.468573 Within R-squared 0.009576			LSDV R-squared 0.170562 Within R-squared 0.004846	

In line with the previous random analysis of the TFP, the coefficient for the backward variable is positive and statistically significant.

Almost all the sectors are competitive industries (less concentrated) with less than 1,800 Herfindahl index using the US department of justice definition of concentrated sectors. And hence, the estimation results holds without any differentiation based on their concentration.

6. Conclusion and Policy Implications

In this thesis work, I focused on the inter-industry productivity spillovers resulting from the Vertical and Horizontal linkages between the multinational and domestic firms. And in it, I analyzed if there is productivity spillovers from foreign direct investment in Ethiopia. I based my analysis on two main data sources coming from the Central Statistics Agency of Ethiopia (CSA) on the medium and large scale manufacturing industries survey and The Ethiopian Development Research Institute (EDRI) for the country's Input-Output Matrix. The survey from CSA is the principal source of facts about the structure and function of the manufacturing industries in the country. With the number of firms' difference in each year, the data is of an unbalanced panel over the years 2004 to 2010.

In order to come up with a concrete and unbiased result, I have taken in to account for the endogeneity/simultaneity of the production function, and other econometric problems underlying a panel data analysis. The results from the analysis are consistent with the presence of productivity spillovers in line with previous works, like that of Javorcik (2004) I found a significant and negative coefficient of the Forward spillovers variable for the Pooled, Fixed effect and the Levinsohn-Petrin estimates. Plus, the Forward variable with lag has also been found significant, at a 0.1 significance level, on the estimation with lags and interaction terms; following Blalock (2008)'s specification for the interaction between the variables. And also, the coefficient for the Backward variable has appeared to be consistently positive and statistically significant on the first differencing, the Levinsohn-Petrin and for the estimation with interaction terms. My TFP analysis from the LP estimation suggests that a one percentage point increase in the foreign presence in the downstream sectors is associated with the 1.1 percent rise in the total output of each supplying industries. Likewise, a one percentage point increase in the weighted share of output in the upstream (or supplying) sectors produced by firms with foreign capital participation is associated with the 1.2 percent decline in the total output.

The Horizontal variable was found to be indeterminate with positive and negative coefficients in different specifications and also, it was not statistically significant in both the Random and fixed effect analysis of the TFP. This actually is consistent with the existing literature that failed to

find any significant horizontal spillovers in developing countries, like that of Javorcik and Aitken and Harrison. Hence, the same holds for the developing country like Ethiopia. Furthermore, I have also not found any significant Backward or Forward spillover effects for the sub sample domestic firms.

From the Forward variable, I noticed that the share of inputs a given domestic industry sources from multinationals has a decreasing effect on the productivity of the firm. Therefore, due consideration should be given for those sectors in which the effect is prominent and strict regulation in licensing such supplying MNCs. And in addition, there should be measures and strategies towards advocating alternative sources of inputs for such domestic industries. In addition to these, according to the 2013 UNITAD report, the credit gap (the level of under-financing through loans and/or overdrafts from financial institutions) for the formal small and medium-sized enterprises (SMEs) in the Sub-Saharan countries is the largest in the world. Hence, improving the financial infrastructure for underserved SMEs and microenterprises is crucial one. As for the backward linkages, the investment authorities should emphasize in attracting those MNCs which take part in further processing of the locally produced items; widening the market for the domestic firms. Knowledge and technological transfer, Job creation, income generation and market creation for local products are some of the very few benefits of the FDI. Furthermore, being a developing country, the government should play a vital role in protecting infant industries from the big MNCs with enough economies of scale. More generally, incentive schemes, infrastructural and financial system development, strengthening the local productive capacity, laying foundation for a well-built environmental, social and governance framework and so forth are expected to harness the fruits of FDI well enough

To sum up, provided the financial and time constraint for this work, I based my work only on the industry level analysis. Yet, it would be better if there was also a consideration for the productivity spillovers analysis directly from the firm level. And hence, further research is needed on this regard in order to incorporate the interactions between individual firms, suppliers and buyers at the very micro level; which will help to identify the effect at the firm level.

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Appendix

Table 1: Summary of Licensed Foreign Investment Projects /Manufacturing/ :By Region of Investment and Status

Since August 22, 1992 - February 24, 2014 G.C

Region of Investment	No of Projects	Capital in '000' birr	Permanent Employees	Temporary Employees
Addis Ababa	1,065	47,759,753	68,743	38,278
Afar	10	1,028,138	733	1,630
Amhara	80	45,708,566	18,933	13,572
B.Gumze	1	1,740	3	15
Dire Dawa	29	18,837,955	7,336	9,319
Gambella	3	3,051,023	2,069	5,112
Harari	5	745,900	590	25
Multiregional	134	7,488,631	8,468	7,454
Oromia	851	91,266,129	119,954	68,556
SNNPR	34	3,266,581	11,375	21,964
Somali	2	12,300	45	30
Tigray	26	2,248,228	4,197	1,343
Grand Total	2,240	221,414,944	242,446	167,298

Source: The Ethiopian Investment Agency

Table 2: Summary of Licensed Foreign Investment Projects /Manufacturing/ : By Year and Status

Since August 22, 1992 - February 24, 2014 G.C

Year	No of Projects	Capital in '000' birr	Permanent Employees	Temporary Employees
1992	2	8,976	213	0
1994	2	208,379	856	0
1995	4	162,235	331	300
1996	15	466,251	1,482	34
1997	17	613,539	2,304	50
1998	7	165,102	827	8
1999	7	357,773	891	120
2000	13	216,252	1,292	499
2001	12	1,354,996	2,533	283
2002	12	268,159	1,242	1,544
2003	53	1,217,844	4,303	1,845
2004	74	1,523,647	4,357	1,905
2005	84	2,053,958	5,495	3,924
2006	128	30,643,301	19,580	22,782
2007	153	3,125,134	8,758	9,001
2008	194	19,691,992	21,233	21,589
2009	188	25,868,075	30,302	14,362
2010	320	21,563,079	21,462	24,318
2011	212	23,197,979	18,926	18,483
2012	292	35,842,737	27,344	20,023
2013	430	51,678,538	62,687	22,925
2014	21	1,187,000	6,028	3,303
Grand Total	2,240	221,414,944	242,446	167,298

Source: The Ethiopian Investment Agency

Table 3: ISIC codes for the manufacturing industries

ID09	**ID09**
1511	Production, processing and preserving of meat, fruit and veg
1514	manufacture of edible oil
1520	Manufacture of dairy products
1531	Manufacture of flour
1533	Manufacture of animal feed
1541	manufacture of bakery
1542	Manufacture of sugar and confecionary
1544	manufacture of pasta and macaroni
1549	Manufacture of food NEC
1551	Distiling rectifying and blending of spirit
1552	Manufacture of wine
1553	Malt liqores and malt
1554	Manufacture of soft drinks
1600	Manufacture of tobacco
1710	spining , weaving and finishing
1711	spining , weaving and finishing
1723	Manufacture of cordage rope and twine
1730	Kniting mills
1810	manufacture of wearing apparal except fur
1910	Tanning and dressing of leather
1920	manufacture of footwear
2000	Manufacture wood and wood products
2100	Manufacture of paper and paper products
2200	Publishing and printing services
2411	Manufacture of basic chemicals except fertilizers
2422	Manufacture of paints varnishes
2423	Manufacture of phrmaceuticals, medicinial
2424	Manufacture of soap detregents, perfumes..
2429	Manufacture of chemical productsNEC
2510	Manufacture of rubber

2520	Manufacture of plastics
2610	Manufacture of glass and glass products
2693	Manufacture of structural clay products
2694	Manufacture of cement ,lime and plaster
2695	Manufacture of articles of concrete, cement
2699	Manufacture of non-metalic NEC
2710	Manufacture of basic iron and steel
2811	Manufacture of structural metal products
2892	Manufacture of cuttlery hand tools....
2893	Manufacture of other fabricated metal products
2899	Manufacture of pumps,compressors, valves and taps
2914	Manufacture of ovens
2925	Manufacture of other general purpose machinery
3130	Manufacture of battries
3420	manufacture of bodies for mothor vechiles
3610	Manufacture of furniture

Table 4: Stationarity

```
Augmented Dickey-Fuller Test

data:  FDI.firm.panel$Yirt
Dickey-Fuller = -4.8985, Lag order = 2, p-value = 0.01
alternative hypothesis: stationary

> adf.test(FDI.firm.panel $FSirt, k=2)

        Augmented Dickey-Fuller Test

data:  FDI.firm.panel$FSirt
Dickey-Fuller = -4.7401, Lag order = 2, p-value = 0.01
alternative hypothesis: stationary
```

Table 5: Estimation with lags and interaction terms following Blalock

	Coefficient	*Std. Error*	*t-ratio*	*p-value*	
const	5.01617	0.440576	11.3855	<0.00001	***
l_Eit	-2.86486	0.28667	-9.9936	<0.00001	***
l_LABOR	0.28651	0.0764237	3.7490	0.00018	***
l_Kit	0.0403511	0.040202	1.0037	0.31556	
l_Mit	3.32017	0.296453	11.1996	<0.00001	***
sq_l_Eit	0.319994	0.0257065	12.4480	<0.00001	***
sq_l_Kit	0.0153343	0.00120059	12.7724	<0.00001	***
sq_l_LABOR	0.0255928	0.00591839	4.3243	0.00002	***
sq_l_Mit	0.00348999	0.0198768	0.1756	0.86063	
lnKitlnLABOR	0.0144982	0.00519495	2.7908	0.00527	***
lnKitlnMit	0.10721	0.0218356	4.9099	<0.00001	***
lnKitlnEit	-0.129006	0.0215606	-5.9834	<0.00001	***
lnLABORlnMit	-0.0320515	0.0347263	-0.9230	0.35606	
lnLABORlnEit	-0.00276193	0.0337194	-0.0819	0.93472	
lnMitlnEit	-0.305343	0.0386431	-7.9016	<0.00001	***
FSirt_1	0.250377	2.16168	0.1158	0.90779	
Horizontal_1	-0.156785	0.0817902	-1.9169	0.05529	*
Backward_1	0.416032	0.386664	1.0760	0.28199	
Forward_1	-0.235161	0.406155	-0.5790	0.56261	

Table 6: Levinsohn-Petrin productivity estimator when the proxy variable is Energy consumption (Eit)

lnYirt	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
lnLABOR	.193256	.0135676	14.24	0.000	.1666641	.2198479
lnKit	.0553272	.0272214	2.03	0.042	.0019742	.1086802
lnEit	.7687249	.0485666	15.83	0.000	.673536	.8639137

Wald test of constant returns to scale: Chi2 = 0.57 (p = 0.4485).

Table 7: Levinsohn-Petrin productivity estimator with Labor and Energy consumption as freely variable inputs and material Input as a proxy variable.

lnYirt	Coef.	Std. Err.	z	P>|z|	[95% Conf. Interval]	
lnLABOR	.1968765	.012702	15.50	0.000	.171981	.2217721
Eit	3.43e-09	9.13e-10	3.76	0.000	1.64e-09	5.22e-09
lnKit	.7310586	.0384338	19.02	0.000	.6557297	.8063875
lnMit	.5149253	.124543	4.13	0.000	.2708255	.7590251

Wald test of constant returns to scale: Chi2 = 12.89 (p = 0.0003).